

**UNIFORM STANDARD SPECIFICATIONS
CLARK COUNTY AREA, NEVADA**

YEAR 2015 REVISIONS

<u>SECTION</u>	<u>TITLE AND REVISIONS SUMMARY</u>	<u>EFFECTIVE DATE</u>
101	"Definitions and Terms" - Specification revised to modify the definition of major contract item and add new definitions for dewatering, nominal diameter, and service connection.	1/1/2015
105	"Control of the Work" - Specification revised to clarify requirements for coordination with utilities, utility conflicts, authorized changes, and final acceptance.	1/1/2015
106	"Control of Materials" - Specification revised to add requirements for certification of laboratory testing technicians.	1/1/2015
107	"Legal Relations and Responsibility to the Public" - Specification revised to clarify requirements for closing or relocating bus stops.	1/1/2015
208	"Trench Excavation and Backfill" - Specification revised to clarify the use of controlled low strength material (CLSM) types in trench backfill.	1/1/2015
401	"Plantmix Bituminous Pavements - General" - Specification revised to add laboratory accreditation and technician certification.	7/1/2015
406	"Prime Coat" - Specification revised to change the requirements for bituminous material.	1/1/2015
501	"Portland Cement Concrete" - Specification revised to add requirements for material, design, testing, equipment, production and placement of non-structural mobile mixed concrete.	7/1/2015
704	"Base Aggregates" - Specification revised to clarify the material and testing requirements of controlled low strength material (CLSM).	1/1/2015
706	"Aggregates for Portland Cement Products" - Specification revised to add requirements for material, design, testing, equipment, production and placement of non-structural mobile mixed concrete.	7/1/2015

SECTION 101

DEFINITIONS AND TERMS

101.01 BLANK

101.02 ADDENDUM

- A. A supplemental addition or deletion to the contract documents prior to the advertised bid opening.

101.03 ADVERTISEMENT

- A. The public announcement, as required by law, inviting bids for work to be performed or materials to be furnished.

101.04 ASSESSMENT ACT CONTRACT

- A. A contract financed by special assessments authorized under, or implemented by, an act of the Legislature of the State or procedural ordinance of a City or the County.

101.05 AWARD

- A. The acceptance by the Contracting Agency of a bid. Refer to ***Subsection [103.02](#), "Award of Contract."***

101.06 BASE COURSE

- A. The layer or layers of specified or selected material of designated thickness on a sub-base or a subgrade to support a surface course.

101.07 BIDDER

- A. An individual, partnership, firm, corporation, or any acceptable combination thereof, or joint venture, submitting a bid for the advertised work.

101.08 BOARD

- A. The officer or body constituting the awarding authority for the Contracting Agency.

101.09 BRIDGE

- A. A structure, including supports, erected over a depression or an obstruction, as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads and having a length measured along the center of roadway of more than 20 feet between under copings of abutments or extreme ends of openings for multiple boxes.
- B. **Length:** The length of a bridge structure is the overall length measured along the line of survey stationing back to back of back walls of abutments, if present, otherwise end to end of the bridge floor; but in no case less than the total clear opening of the structure.
- C. **Roadway Width:** The clear width measured at right angles to the longitudinal centerline of the bridge between the bottom of curbs or guard timbers or in the case of multiple height of curbs, between the bottoms of the lower risers and in the case of no curbs or guard timbers, between the inner faces of parapet or railing at the bottom.

101.10 CALENDAR DAY

- A. Every day shown on the calendar.

101.11 CONTRACT CHANGE ORDER OR FIELD CHANGE ORDER

- A. A written order issued by the Engineer or Contracting Agency as provided in the contract documents, to the Contractor, covering changes in the plans, specifications or quantities or both, within the scope of the contract and establishing the basis of payment and time adjustments for the work affected by the change.

101.12 CHANNEL

- A. A natural or artificial water course.

101.13 CONTRACT

- A. The written agreement between the Contracting Agency and the Contractor setting forth the obligations of the parties thereunder, including, but not limited to the performance of the work, the furnishing of labor and materials, and the basis of payment.
- B. The contract includes the invitation for bids, proposal, contract form and contract bond, standard specifications, supplemental specifications, special provisions, general and detailed plans, notice to proceed, and any addenda, change orders, and supplemental agreements that are required to complete the construction of the work in an acceptable manner, including authorized extensions and basis of payment thereof, all of which constitute one instrument.

101.14 CONTRACTING AGENCY

- A. The party of the first part to a contract which may be any of the following entities: Boulder City, Nevada; City of Henderson, Nevada; City of Las Vegas, Nevada; City of North Las Vegas, Nevada; City of Mesquite, Nevada; Las Vegas Valley Water District, Las Vegas, Nevada; Clark County Water Reclamation District, Las Vegas, Nevada; Southern Nevada Water Authority, Las Vegas, Nevada; Clark County Regional Flood Control District, Las Vegas, Nevada; Regional Transportation Commission of Southern Nevada, Las Vegas, Nevada; and Clark County, Nevada.

101.15 CONTRACT ITEM (PAY ITEM)

- A. An item of work specifically described and for which a price, either Unit or Lump Sum, is provided. It includes the performance of all work and the furnishing of all labor, equipment, and materials described in the text of a specific item included in the contract or described in the Standard Specifications, Supplemental Specifications, or Special Provisions of the contract. Contract items are numbered so that the first three digits of the item number corresponds to the section of the same number. Thus, in Item No. 203.01, which is the item number for roadway excavation, the number 203 is the section number and corresponds to **Section 203, "Excavation and Embankment"** of the Standard Specifications, Supplemental Specifications and Special Provisions.
- B. Each contract item shall be constructed under the specifications contained in the section of the same number, i.e., the number preceding the aforementioned last two digits.

101.16 CONTRACTOR

- A. The person, firm, partnership, corporation, permittee, subdivider, or other entity who has entered into a contract or agreement with the Contracting Agency. Where work is done under permit issued by the Contracting Agency, the permittee shall be construed to be the Contractor. Also, a subdivider who does land development and other work under contract with the Contracting Agency.

101.17 CONTRACT TIME

- A. The number of days allowed for completion of the contract, including authorized time extensions.

101.18 CULVERT

- A. Any structure not classified as a bridge which provides an opening under the roadway.

101.19 DETOUR

- A. A temporary route for traffic around a closed portion of road.

101.20 DEWATERING

- A. Removal and/or lowering of any surface or subsurface water by a method chosen by the Contractor and acceptable to the Engineer, which results in a ground moisture content that enables construction to be carried out under relatively dry and stable conditions.

101.20101.21 DIVIDED HIGHWAY

- A. A highway with separated roadways for traffic in opposite directions.

101.21101.22 DRAWINGS

- A. That part of the Contract Documents prepared or approved by the Contracting Agency which graphically shows the scope, intent, and character of the Work to be performed by the Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.

101.22101.23 EMPLOYEE

- A. Any person working on the project mentioned in the contract of which these specifications are a part, and who is under the direction and control, or received compensation from the Contractor or the Contractor's subcontractor.

101.23101.24 ENGINEER

- A. The Chief Engineer of the Contracting Agency or other person designated by the Board acting directly and through the Chief Engineer's duly authorized representative.

101.24101.25 EQUIPMENT

- A. All machinery and equipment, together with the necessary supplies for upkeep and maintenance, also tools and apparatus necessary for the proper construction and acceptable completion of the work.

~~101.25~~101.26 EXTRA WORK

- A. An item of work not provided for in the contract as awarded, but found essential by the Contracting Agency to the satisfactory completion of the contract within its intended scope.

~~101.26~~101.27 FRONTAGE ROAD OR FRONTAGE STREET

- A. A local street or road auxiliary to and located generally on the side of an arterial highway for service to abutting property and adjacent areas and for control of access.

~~101.27~~101.28 GUARANTEE BOND

- A. The approved form of security executed by the Contractor and the Contractor's surety or sureties guaranteeing the work against defect and failures.

~~101.28~~101.29 HIGHWAY

- A. A general term denoting a public way for purposes of vehicular travel, including the entire area within the right-of-way.

~~101.29~~101.30 HOLIDAYS

- A. Any day established by law or agreed as a holiday for employees of the Contracting Agency.

~~101.30~~101.31 HYDRAULIC CEMENT

- A. An inorganic material or a mixture of inorganic materials that sets and hardens by chemical reaction with water by formation of hydrates, and is capable of doing so under water.

~~101.31~~101.32 INSPECTOR

- A. The Engineer's or Contracting Agency's authorized representative assigned to make detailed inspections of contract performance.

~~101.32~~101.33 INTERAGENCY QUALITY ASSURANCE COMMITTEE (IQAC)

- A. An ad hoc multi-jurisdictional and agency committee established for the purpose of simplifying the material approval process and promoting the consistent enforcement of the Uniform Standard Specifications and Drawings, Clark County Area, Nevada.

~~101.33~~101.34 LABORATORY

- A. The testing laboratory of the Contracting Agency or of any other testing laboratory which may be designated by the Engineer.

~~101.34~~101.35 MAJOR CONTRACT ITEM

- A. A "Major Item" shall be ~~construed-defined~~ to be any individual bid item included in the proposal that has a total cost equal to or greater than \$50,000 or ~~5-10~~ percent of the total contract cost, whichever is the lesser amount. Major Items may or may not be included in the bid proposal as an individual contract item. A major item may be considered subsidiary or incidental to a contract item in the bid proposal and the cost of the major item shall be included in the contract item. The total contract cost shall be computed on the basis of the original bid or proposal quantities and contract unit prices.

101.35101.36 MATERIALS

- A. Any substances specified for use in the construction of the project and its appurtenances.

101.36101.37 MEDIAN

- A. That portion of a divided highway separating the travel ways for traffic, generally in opposite directions.

101.38 NOMINAL DIAMETER

- A. The inside diameter of a standard pipe as specified by the manufacturer.

101.37101.39 NOTICE TO BIDDERS

- A. The official notice inviting bids for the proposed work or materials.

101.38101.40 NOTICE TO PROCEED

- A. A written notice to the Contractor to proceed with the contract work including, when applicable, the date of beginning of contract time.

101.39101.41 PAVEMENT STRUCTURE

- A. The combination of base course and surface course placed on a subgrade to support the traffic load and distribute it to the roadbed.

101.40101.42 LABOR AND MATERIAL PAYMENT BOND

- A. The approved form of security executed by the Contractor and the Contractor's surety or sureties to guarantee the payment of persons furnishing materials or persons performing labor under the contract.

101.41101.43 PERFORMANCE BOND

- A. The approved form of security executed by the Contractor and the Contractor's surety or sureties to guarantee the faithful performance of all work under said contract within the prescribed time limit and that materials and workmanship will be free from original or developed defects.

101.42101.44 PLANS

- A. The approved project plans and Standard Drawings, profiles, typical cross sections, and supplemental drawings, or exact reproductions thereof, which show the location, character, dimensions, and details of the work to be performed. All such documents are to be considered as a part of the plans whether or not noted in the Special Provisions.
- B. In the above definition, the following terms are defined as follows:
1. Standard Drawings - The Standard Drawings of the Contracting Agency.
 2. Project Drawings - The Project Drawings are specific details and dimensions peculiar to the work and are supplemented by the Standard Drawings insofar as the same may apply.

~~101.43~~101.45 PROFILE GRADE

- A. The trace of a vertical plane intersecting the top surface of the proposed structural section as shown on the plans. Profile grade means either elevation or gradient of such trace according to the context.

~~101.44~~101.46 PROJECT

- A. The specific improvement to be constructed together with all appurtenances and construction to be performed thereon at the prices quoted.

~~101.45~~101.47 PROPOSAL

- A. The offer of a bidder, on the prescribed form, to perform the work and to furnish the labor and materials at the prices quoted.

~~101.46~~101.48 PROPOSAL FORM

- A. The approved form on which the Contracting Agency requires bids to be prepared and submitted for the work.

~~101.47~~101.49 PROPOSAL GUARANTEE

- A. The security furnished with a bid to guarantee that the bidder will enter into the contract if bidder's bid is accepted.

~~101.48~~101.50 QUALITY ASSURANCE (QA)

- A. Planned and systematic operations conducted to ensure that the operations and/or product meets specifications. QA encompasses the Engineer's review and oversight of the Contractor's "Quality Control"; verifying the results of "Quality Control"; and inspecting for conformance to plans and specifications. QA is the responsibility of the "Engineer."

~~101.49~~101.51 QUALITY CONTROL (QC)

- A. Planned and specified operations necessary to construct items that will meet the requirements for quality and performance as specified. QC includes, but should not be limited to controlling the quality of raw materials, produced materials assemblies, components, finished product, and construction process. QC is the responsibility of the "Contractor."

~~101.50~~101.52 RIGHT-OF-WAY OR EASEMENT

- A. A general term denoting land, property, or interest therein, usually in a strip, acquired for or devoted to a highway or other improvements.

~~101.51~~101.53 ROAD

- A. A general term denoting a public way for purposes of vehicular travel, including the entire area within the right-of-way.

~~101.52~~101.54 ROADBED

- A. The graded portion of a highway within top and side slopes, prepared as a foundation for the pavement structure and shoulders.

~~101.53~~101.55 ROADSIDE

- A. A general term denoting the area adjoining the outer edge of the roadway. Extensive areas between the roadways of a divided highway may also be considered roadside.

~~101.54~~101.56 ROADSIDE DEVELOPMENT

- A. Those items necessary to the complete improvement which provides for the preservation of landscape materials and features; the rehabilitation and protection against erosion of all areas disturbed by construction through seeding, sodding, mulching, and the placing of other ground covers; such suitable planting and other improvements as may increase the effectiveness and enhance the appearance of the improvement.

~~101.55~~101.57 ROADWAY

- A. The portion of a highway within limits of construction.

~~101.58~~ SERVICE CONNECTION

- A. All or any portion of a utility, including sewer laterals, conduit, wire, cable or duct, including meters, between a utility distribution or collection line and an individual customer or customers. This definition does not establish ownership.

~~101.56~~101.59 SHOULDER

- A. The portion of the roadway contiguous with the traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses.

~~101.57~~101.60 SIDEWALK

- A. That portion of the roadway primarily constructed for the use of pedestrians.

~~101.58~~101.61 SPECIAL PROVISIONS

- A. Additions and revisions to the standard and supplemental specifications covering conditions peculiar to an individual project.

~~101.59~~101.62 SPECIFICATIONS

- A. The directions, provisions, and requirements contained in the Standard Specifications and supplemental specifications as modified by the Special Provisions. Whenever the term "these specifications" is used in this book, it means the provisions set forth in this book.

~~101.60~~101.63 STREET

- A. A general term denoting a public way for purposes of vehicular travel, including the entire area within the right-of-way.

~~101.61~~101.64 SUBCONTRACTOR

- A. Any individual, firm, or corporation to whom the Contractor, with the consent of the Contracting Agency, sublets any part of the contract.

~~101.62~~101.65 SUBGRADE

- A. The top of a roadbed upon which the base courses and/or the pavement structure and shoulders are constructed.

~~101.63~~101.66 SUBSTRUCTURE

- A. All of that part of the structure below the bearings of simple and continuous spans, skewbacks or arches, and tops of footings or rigid frames, together with backwall, wingwalls, and wing protection railings.

~~101.64~~101.67 SUPERINTENDENT

- A. The Contractor's authorized representative in responsible charge of the work, present on the work at all times during the progress to supervise and direct the construction, to receive and fulfill instructions from the Engineer, and to accept orders for changed and extra work.

~~101.65~~101.68 SUPERSTRUCTURE

- A. The entire structure except the substructure.

~~101.66~~101.69 SUPPLEMENTAL AGREEMENT

- A. A written agreement within the scope of the project made and entered into by and between the Contractor and the Contracting Agency covering work not otherwise provided for, revisions in or amendments to the terms of the contract, or conditions specifically prescribed in the specifications as requiring supplemental agreements. Such supplemental agreements become a part of the contract when approved and properly executed.

~~101.67~~101.70 SUPPLEMENTAL SPECIFICATIONS

- A. Additions and revisions to the Standard Specifications that are approved subsequent to the issuance of the published specifications.

~~101.68~~101.71 SURETY

- A. The corporation, partnership, or individual, other than the Contractor, executing a bond furnished by the Contractor.

~~101.69~~101.72 SURFACE COURSE

- A. The top layer of an improvement.

~~101.70~~101.73 TRAFFIC LANE

- A. The portion of a traveled way for the movement of a single line of vehicles.

~~101.71~~101.74 TRAVELED WAY

- A. That portion of roadway for the movement of vehicles, exclusive of shoulders and auxiliary lanes.

~~101.72~~101.75 UNSUITABLE MATERIAL

- A. Soils that fail to meet the AASHTO Soil Classification System (AASHTO M145) A-1 through A-7 classifications; are highly organic; or are determined to be contaminated.

~~101.73~~101.76 UTILITY

- A. Tracks, overhead or underground wires, pipelines, conduits, ducts, or structures, sewers, or storm drains owned, operated, or maintained in or across a public right-of-way or private easement.

~~101.74~~101.77 WORK

- A. Work will mean furnishing all labor, materials, equipment, and other incidentals necessary or convenient to the successful completion of the project and the carrying out of all of the duties and obligations as imposed by the contract.

~~101.75~~101.78 WORKING DAY

- A. A day on which weather and other conditions not under the control of the Contractor will permit construction operations to proceed for the major part of the day (5 hours) with the normal working force engaged in performing the controlling item or items of work which would be in progress at that time, exclusive, however, of Saturdays, Sundays, holidays, and any day that is incumbent upon the Contractor, by means of a labor union, to observe as a holiday. However, if the Contractor elects to work on such days, those days will be considered as a working day.
- B. Attention is directed to **Subsections [108.04](#), "Limitation of Operations,"** and **[108.08](#), "Determination and Extension of Contract Time."**

~~101.76~~101.79 WORKING DRAWINGS

- A. Stress sheets, shop drawings, erection plans, falsework plans, framework plans, cofferdam plans, bending diagrams for reinforcing steel, or any other supplementary plans or similar data which the Contractor is required to submit to the Engineer for approval. Working Drawings are not part of the Contract Documents.
- B. In order to avoid cumbersome and confusing repetition of expressions in these specifications, it is provided that whenever anything is, or is to be, done, if, as, or, when, or where "contemplated, required, determined, directed, specified, authorized, ordered, given, designated, indicated, considered necessary, deemed necessary, permitted, reserved, suspended, established, approval, approved, disapproved, acceptable, unacceptable suitable, accepted, satisfactory, unsatisfactory, sufficient, insufficient, rejected, or condemned," it shall be understood as if the expression were followed by the words "by the Contracting Agency."

SECTION 105

CONTROL OF THE WORK

105.01 AUTHORITY OF THE ENGINEER

- A. The Engineer will decide all questions that may arise as to the quality and acceptability of materials furnished and work performed and as to the rate of progress of the work; and all questions that may arise as to the interpretation of the plans and specifications.
- B. The Engineer will have the authority to suspend the work wholly or in part due to the failure of the Contractor to correct conditions unsafe for the workmen or the general public; for failure to comply with the technical provisions of the contract; for failure to carry out orders; for such periods as the Engineer may deem necessary due to unsuitable weather; and for conditions considered unsuitable for the prosecution of the work.
- C. Whenever the Contractor fails to carry out orders of the Engineer, the Engineer will have executive authority to enforce such orders and the Engineer's decision shall be final. In the event the Contractor fails to execute work ordered by the Engineer within a reasonable period of time, the Engineer may, after giving notice in writing to the Contractor, proceed to have such work performed as deemed necessary and the cost thereof shall be deducted from compensation due or which may become due the Contractor on the contract.
- D. Decisions of the Engineer shall be subject to appeal to the Board, whose decisions shall be final and conclusive. Such appeal shall be in writing and shall be made within 10 calendar days, but in the meantime the Contractor shall diligently proceed with the work.

105.02 PLANS AND WORKING DRAWINGS

- A. The contract plans and drawings do not purport to show all the details of the work. These documents are intended to illustrate the character and extent of the performance desired under the contract; therefore, they may be supplemented or revised from time to time, as the work progresses, by the Engineer or (subject to approval of the Engineer) by the Contractor. The Contractor will keep one set of plans available on the work at all times.
- B. The plans may be supplemented by such working drawings as are necessary to adequately control the work. Working drawings for structures shall be furnished by the Contractor. Working Drawings shall include stress sheets, shop drawings, erection plans, fabrication sheets, falsework plans, cofferdam plans, bending diagrams for reinforcing steel, or any other supplementary plans or similar data required by the Engineer. Unless otherwise specified, all working drawings shall be submitted in triplicate 10 days prior to start of related work and approved by the Engineer. Such approval shall not relieve the Contractor of any of the Contractor's responsibility under the contract for the successful completion of the work. It is mutually agreed that the Contractor shall be responsible for agreement of dimensions and details as well as for conformity of the Contractor's working drawings with the approved plans and specifications.
- C. The contract price will include the cost of furnishing all working drawings.

105.03 CONFORMITY WITH PLANS AND SPECIFICATIONS

- A. Work performed and materials furnished shall be in conformity with the lines, grades, cross sections, dimensions, and materials requirements, including tolerances, shown on the plans or indicated in the specifications.

- B. In the event the Engineer finds the materials or the finished product in which the materials are used not in conformity with the plans and specifications, but that acceptable work has been produced, the Engineer shall then make a determination if the work shall be accepted and remain in place. In this event, the Engineer will document the basis of acceptance by contract modification concurred in by the Contracting Agency which will provide for an appropriate adjustment in the contract price for such work or materials as the Engineer deems necessary to conform to the Engineer's determination based on engineering judgment.
- C. In the event the Engineer finds the materials or the finished product in which the materials are used or the work performed are not in conformity with the plans and specifications and have resulted in an inferior or unsatisfactory product, the work or materials shall be removed and replaced or otherwise corrected by the Contractor at no additional cost to the Contracting Agency.

105.04 COORDINATION OF PLANS, SPECIFICATIONS, SUPPLEMENTAL SPECIFICATIONS, AND SPECIAL PROVISIONS

- A. The specifications, supplemental specifications, plans, special provisions, and all supplementary documents are essential parts of the contract, and a requirement occurring in one is as binding as though occurring in all. These documents are intended to be complementary and to describe and provide for a complete work. In case of discrepancy, the following precedence will govern:
 1. Permits from other agencies as may be required by law.
 2. Special Provisions.
 3. Plans.
 4. Uniform Standard Drawings.
 5. Uniform Standard Specifications.
 6. Reference Specifications.
- B. Change orders, supplemental agreements, and approved revisions to plans and specifications will take precedence over Items 2, 3, 4, 5, and 6 listed above. Detailed plans shall have precedence over general plans.
- C. The Contractor shall take no advantage of any apparent error or omission in the plans or specifications. In the event the Contractor discovers such an error or omission, the Contractor shall immediately notify the Engineer. The Engineer will then make such corrections and interpretations as may be deemed necessary for fulfilling the intent of the plans and specifications.

105.05 COOPERATION BY CONTRACTOR

- A. The Contractor will be supplied with a minimum of 4 sets of approved plans and contract assemblies including special provisions, one set of which the Contractor shall keep available on the work at all times. Additional copies of plans and special provisions may be obtained by the Contractor upon written request to the Contracting Agency.
- B. The Contractor shall give the work constant attention necessary to facilitate the progress thereof, and shall cooperate with the Engineer, the Engineer's inspectors, and other contractors in every way possible.

- C. The Contractor shall maintain a telephone for the duration of the contract, at no additional cost to the Contracting Agency, where the Contractor or the Contractor's authorized representative may be reached directly or by message at all times.
- D. The prime Contractor shall have on the work at all times, as the Contractor's agent, a competent superintendent capable of reading and thoroughly understanding the plans and specifications and thoroughly experienced in the type of work being performed, who shall receive instructions from the Engineer or the Engineer's authorized representatives. Such superintendent shall be designated in writing before starting work. The superintendent shall have full authority to execute orders or directions of the Engineer without delay, and to promptly supply such materials, equipment, tools, labor, and incidentals as may be required. Such superintendent shall be furnished irrespective of the amount of work sublet.
- E. Whenever the Contractor or the Contractor's authorized representative is not present on any particular part of the work where it may be desired to give direction, orders will be given by the Engineer to the Contractor's superintendent, foreman, or other person in charge of the operation, who is present, and these orders shall have the same force and effect as if given to the Contractor or the Contractor's designated representative.
- F. Any order given by the Engineer, not otherwise required by the specifications to be in writing, will on request of the Contractor be given or confirmed by the Engineer in writing.

105.06 COOPERATION WITH UTILITIES

- A. The Permittee, in the case of private contract, and the Contracting Agency, in the case of cash contract or Special Improvement District contract, will search known substructure records which describe the location of utility substructures, and will indicate on the plans for the project those substructures, except for service connections, which may affect the work. Information regarding removal, relocation, abandonment, or installation of new utilities will be furnished to prospective bidders.
- B. Where underground main distribution conduits such as water, gas, sewer, electric power, telephone, or cable television are shown on the plans, the Contractor, for the purpose of preparing the Contractor's bid, shall assume that every property parcel will be served by a service connection for each type of utility.
- C. At least 2 working days before entering on the work, the Contractor shall notify all the utility owners to mark or otherwise indicate the approximate location of their subsurface facilities including, but not limited to, structures, main conduits, and service connections. This requirement will not apply to sewer and storm drain installations where their location and depth are shown on the plans for the project.
- D. It shall be the Contractor's responsibility to determine the location and depth of all utilities, including service connections, for which approximate locations have been marked by the respective owners and which the Contractor believes may affect or be affected by the Contractor's operations. If no pay item is provided in the contract for this work, full compensation for such work shall be considered as included in the prices bid for other items of work.
- E. The Contractor shall not interrupt the service function or disturb the supporting base of any utility without authority from the owner or an order from the Contracting Agency.
- F. Where protection is required to ensure support of utilities, the Contractor shall, unless otherwise provided, furnish and place the necessary protection at no additional cost to the Contracting Agency.

- G. Upon learning of the existence and location of any utility omitted from or shown incorrectly on the plans, or not properly marked, the Contractor shall immediately notify the Engineer in writing. When authorized by the Engineer, support or protection of the utility will be paid for as provided in **Subsection 104.03, "Extra Work."**
- H. The Contractor shall immediately notify the Engineer and the utility owner if the Contractor disturbs or damages any utility. The Contractor shall bear the costs of repair or replacement of any utility damaged if properly located as provided.
- I. When placing concrete around or contiguous to any utility installation, the Contractor, at no additional cost to the Contracting Agency, shall (1) furnish and install a 2-inch cushion of expansion joint material or other similar resilient material; or (2) provide a sleeve or other opening which will result in a 2-inch minimum clear annular space between the concrete and the utility; or (3) provide other acceptable means to prevent embedment in or bonding to the concrete. The standards of the affected utility company shall prevail. Where concrete is used for backfill or for structures which would result in embedment, or partial embedment, of a metallic utility installation, or where the coating, bedding, or other cathodic protection system is exposed or damaged by the Contractor's operations, or as may be required by the work, the Contractor shall notify the Engineer and arrange to secure the advice of the affected utility owner regarding the procedures required to maintain or restore the integrity of the system.
- J. Unless otherwise specified, the Contractor shall remove all interfering portions of utilities shown on the plans or indicated in the bid documents as "abandoned" or "to be abandoned in place." Before starting removal operations, the Contractor shall ascertain from the Contracting Agency whether the abandonment is complete, and the costs involved in the removal and disposal shall be absorbed in the bid for the items of work necessitating such removals.
- K. When feasible, the owners responsible for utilities within the area affected by the work shall complete their necessary installations, relocations, repairs or replacements before commencement of work by the Contractor. When the Special Provisions or plans indicate that a utility installation is to be relocated, altered, or constructed by others, the Contracting Agency will conduct all negotiations with the owners and the work will be done at no cost to the Contractor, except as provided in **Subsection 107.17, "Contractor's Responsibility for Utility Property and Service."** Utilities that are relocated in order to avoid interference with the proposed permanent work shall be protected in their relocated position and the cost of such protection shall be absorbed in the various items of the contract.
- L. A utility company installing a new line is responsible for relocation of other utility company facilities if the new line conflicts with existing locations.
- M. When the plans or specifications provide for the Contractor to alter, relocate, or reconstruct a utility, all costs for such work shall be included in the bid for the items of work necessitating such work. Temporary or permanent relocation or alteration of utilities requested by the Contractor for the Contractor's own convenience shall be the Contractor's responsibility, and the Contractor shall make all arrangements and bear all costs.
- N. The utility owner will relocate service connections as necessary within the limits of the work or within temporary construction or slope easement unless otherwise specified. When directed by the Engineer, the Contractor shall arrange for the relocation of service connections as necessary between the meter and property line, or between a meter and the limits of temporary construction or slope easements. The relocation of such service connections will be paid for in accordance with provisions of **Subsection 104.03, "Extra**

- Work."** Payment will include the restoration of all existing improvements which may be affected thereby. The Contractor may, for the Contractor's own convenience or to expedite the work, agree with the owner of any utility to disconnect and reconnect interfering service connections. The Contracting Agency will not be involved in any such agreement.
- O. The Contractor shall notify the Contracting Agency of the Contractor's construction schedule insofar as it affects the protection, removal, or relocation of utilities. This notification shall be in writing and shall be included as a part of the construction schedule required by **Subsection 108.03, "Prosecution and Progress."** The Contractor shall notify the Contracting Agency in writing of any subsequent changes in the Contractor's construction schedule which will affect the time available for protection, removal, or relocation of utilities.
- P. The Contractor will not be entitled to damages or additional payment for delays attributable to utility relocations or alterations if correctly located, noted, and completed. The Contractor may be given an extension of time for unforeseen delays attributable to utility relocations or alterations not shown or incorrectly shown on the plans, or for unreasonably protracted interference by utilities in performing work correctly shown on the plans. If the Contractor sustains loss due to delays attributable to interferences, relocations, or alterations which could not have been avoided by the judicious handling of forces, equipment, or plant, there shall be paid to the Contractor such amount as the Contracting Agency may find to be fair and reasonable compensation for such part of the Contractor's actual loss as was unavoidable as provided in **Subsection 108.12, "Right-of-Way Delays."**
- Q. When necessary, the Contractor shall so conduct the Contractor's operations as to permit access to the work site and provide time for utility work to be accomplished during the progress of the contract work.
- R. The Owner and Engineer do not guarantee that all existing utilities are shown on the contract drawings, or that the utilities are shown in their exact locations. The Owner may or may not have indicated utility service connection laterals on the Contract Drawings.
- S. During all time periods when any utility valve, manhole, vault, or pull box may be buried or otherwise rendered inaccessible, the Contractor shall have personnel and equipment on standby (respond within 1 hour) to uncover any valve, manhole, vault or pull box when requested by the Engineer or owning agency.
1. All utility valves, manholes, vaults, or pull-boxes which are buried shall be conspicuously marked in a fashion acceptable to the owner and Engineer by the Contractor to allow their location to be determined by the Engineer or utility personnel under adverse conditions, (inclement weather or darkness).
 2. All cost for providing standby personnel and equipment and for uncovering buried facilities shall not be paid for separately but shall be considered incidental to the items of work associated with the burial except for service connections, which may affect the work.
- T. The Contractor shall pothole to determine the exact vertical and horizontal location of all existing utilities indicated on the Drawings, or marked in the field, crossing or potentially impacting the proposed reinforced concrete box, pipeline, mains, and laterals, at least (10) days in advance of the construction of any underground facility.
1. Contractor shall provide Engineer all pothole information obtained including measurements, dimensions, elevations, types and sizes of utilities within one working day following the potholing.

- U. During the performance of contract work, the owner of any utility affected by the work shall have the right to enter, when necessary, upon any portion of the work for the purpose of maintaining service and of making changes in, or repairs to said utility.
- V. When the plans or specifications provide for the Contractor to alter, relocate, or reconstruct a utility, the bid prices shall include the cost of any temporary bypasses that may be required by the affected utility. It is the Contractor's responsibility under Subsection 102.05 "Examination of Plans, Specifications, Contract Documents, and Site of Work" to satisfy himself prior to bidding as to the requirements of each utility and utility modification.
- Q-W. The Contractor shall not shut off the water supply to a hydrant, nor in any way, prevent access to a fire hydrant until he has secured permission to do so from the proper authorities.

105.07 COOPERATION BETWEEN CONTRACTORS

- A. The Contracting Agency reserves the right at any time to contract and perform other or additional work on or near the work covered by the contract.
- B. When separate contracts are let within the limits of any one project, each Contractor shall conduct Contractor's work so as not to interfere with or hinder the progress or completion of the work being performed by the other Contractors. Contractors working on the same project shall cooperate with each other as directed.
- C. Each Contractor involved shall assume all liability, financial or otherwise, in connection with Contractor's contract and shall protect and save harmless the Contracting Agency from any and all damages or claims that may arise because of inconvenience, delay, or loss experienced by Contractor because of the presence and operations of other Contractors working within the limits of the same project.
- D. The Contractor shall arrange Contractor's work and shall place and dispose of the materials being used so as not to interfere with the operations of other Contractors within the limits of the same project. Contractor shall join Contractor's work with that of the others in an acceptable manner and shall perform the work in proper sequence to that of the others.

105.08 CONSTRUCTION STAKES, LINES AND GRADES

- A. The Contractor shall notify the Engineer at least 7 days before starting work in order that the Engineer may take necessary measures to ensure the preservation of survey monuments and bench marks. The Contractor shall not disturb permanent survey monuments or bench marks without the consent of the Engineer, and shall bear the expense of replacing any that may be disturbed without permission. Replacement shall be done only by the Engineer.
- B. When a change is made in the finished elevation of the pavement of any roadway in which a permanent survey monument is located, the Contractor shall adjust the monument cover to the new grade unless otherwise specified.
- C. The Contractor shall preserve property line and corner survey markers except where their destruction is unavoidable, and the Contractor is proceeding in accordance with accepted practice. Markers that otherwise are lost or disturbed by Contractor's operations shall be replaced at the Contractor's expense by a Registered Land Surveyor.

- D. Except for private contracts, the Engineer will perform and be responsible for the accuracy of surveying adequate for construction. The Contractor shall be responsible for preserving construction survey stakes and marks for the duration of their usefulness. If any construction survey stakes are lost or disturbed and need to be replaced, such replacement shall be by the Engineer at the expense of the Contractor.
- E. The Contractor shall notify the Engineer at least 2 working days before Contractor will require survey services in connection with the laying out of any portion of the work. The Contractor shall dig all holes necessary for line and grade stakes.
- F. The Engineer will furnish and set construction stakes establishing lines and grades for street excavation, finished base gravel, curb and gutter, walks, structures, and utilities, and will furnish the Contractor all the necessary information relating to the lines and grades. These stakes and marks shall constitute the field control by and in accordance with which the Contractor shall govern and execute the work.
- G. The line and grade stakes will be offset from the construction area. The stakes will show the offset distance, stationing, and required cut or fill to the finished grade or flow line as indicated on the plans. Grade stakes shall be set by the Engineer to the finished grade of the subgrade and also of the base gravel and the tops of these stakes marked blue or red. All stakes and grade shall be set with a surveyor's level or transit.
- H. The Contractor shall construct the work in accordance with the Engineer's stakes and marks, making use of them before they are disturbed, and shall be charged with full responsibility for conformity and agreement of the work with such stakes and marks. The Contractor shall be held responsible for the preservation of all stakes and marks, and if, in the opinion of the Engineer, any of the stakes or marks have been carelessly or willfully destroyed or disturbed by the Contractor, the cost of replacing them shall be charged against, and deducted from, the payment for the work.
- I. Surveying by private engineers on work under the control of the Contracting Agency shall conform to the quality and practice required by the Engineer.
- J. Work upon completion shall conform to the lines, elevations, and grades shown on the plans, or as ordered by the Engineer.
- K. Three consecutive points set on the same slope shall be used together so that any variation from a straight grade can be detected. Any such variation shall be reported to the Engineer. In the absence of such report, the Contractor shall be responsible for any error in the grade of the finished work.
- L. Grades for underground conduits will be set at the surface of the ground. The Contractor shall transfer them to the bottom of the trench.

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105.10 DUTIES OF THE INSPECTOR

- A. Inspectors for the Contracting Agency will be authorized to inspect all work done and all materials furnished. Such inspection may extend to all or any part of the work and to the preparation, fabrication, or manufacture of the materials to be used. The inspector will not be authorized to issue instructions contrary to the plans and specifications, or to act in any capacity for the Contractor.

105.11 INSPECTION

- A. All materials and each part or detail of the work shall be subject to inspection by the Engineer. The Engineer shall be provided acceptable access to all parts of the work and shall be furnished with such information and assistance by the Contractor as required to make a complete and detailed inspection.
- B. Any work done or materials used without inspection by an authorized Contracting Agency representative may be ordered removed unless the material meets the specifications and shall be replaced at no additional cost to the Contracting Agency unless the Contracting Agency representative failed to inspect after having been given notice in writing that the work was to be performed. If the noninspected work or material proves acceptable the work or material may remain, but any expenses entailed in a late inspection shall be the Contractor's.
- C. If the Engineer requests it, the Contractor, at any time before acceptance of the work, shall remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of the work to the standard required by the specifications. Should the work thus exposed or examined prove acceptable, the uncovering, or removing and the replacing of the covering, or making good of the parts removed will be paid for as extra work; but should the work so exposed or examined prove unacceptable, the uncovering, or removing and replacing of the covering, or making good of the parts removed will be at no additional cost to the Contracting Agency.
- D. When facilities of any unit of government or political subdivision or of any railroad corporation or public utility corporation are adjusted or constructed as a part of the work covered by this contract, its respective representatives shall have the right to inspect the work. Such inspection shall in no sense make any unit of government or political subdivision or any railroad corporation or public utility corporation a party to this contract, and shall in no way interfere with the rights of either party thereunder.

105.12 REMOVAL OF UNACCEPTABLE AND UNAUTHORIZED WORK

- A. All work which does not conform to the requirements of the contract will be considered as unacceptable work, unless otherwise determined acceptable under the provisions in ***Subsection [105.03](#), "Conformity with Plans and Specifications."***
- B. Unacceptable work, whether the result of poor workmanship, use of defective materials, damage through carelessness, or any other cause, found to exist prior to the final acceptance of the work, shall be removed immediately and replaced in an acceptable manner.
- C. Work done contrary to the instructions of the Engineer, work done beyond the lines shown on the plans, or as given except as herein specified, or any extra work done without authority, will be considered as unauthorized and will not be paid for under the provisions of the contract. Work so done may be ordered removed or replaced at no additional cost to the Contracting Agency.
- D. Upon failure on the part of the Contractor to comply forthwith with any order of the Engineer, made under the provisions of this article, the Contracting Agency will have authority to cause unacceptable work to be remedied or removed or replaced and unauthorized work to be removed and to withhold the costs from any money due or to become due to the Contractor.

105.13 LOAD AND SPEED RESTRICTIONS

- A. The Contractor shall be responsible for all damage to the work caused by Contractor's hauling equipment.
- B. In hauling material for incorporation in portions of the project, loads which are in excess of the limits set by the Contracting Agency will not be permitted on any existing bridge or new and existing bituminous base and surface, cement treated base, or Portland cement concrete paving which is to remain in place for vehicular traffic within the project or between the project and the pits or other sources of materials. Load limits established by the Contracting Agency for the project shall be complied with regardless of the source of materials, whether from described pits, approved pits, or commercial sources. Unless otherwise stated in the Special Provisions, the maximum loads shall not exceed the limits set forth in Chapter 484, "Traffic Laws," of the Nevada Revised Statutes and all acts amendatory thereto or supplementary thereto.
- C. Construction loads greater than legal loads may be carried over any new bridge structure within the project providing the Contractor complies with all of the following limitations and provisions:
 - 1. Concrete in any such structure shall have attained designed strength as shown on the structure plans.
 - 2. The gross load of the vehicle shall not exceed 108,000 pounds.
 - 3. Gross load on any individual axle shall not exceed 48,000 pounds.
 - 4. The gross load on any individual set of tandem axles spaced not more than 6 feet apart shall not exceed 72,000 pounds.
 - 5. The center to center spacing of individual axles or center to center spacing of pairs of tandem axles shall not be less than 14 feet.
 - 6. No more than one lane of vehicles shall operate over any structure.
 - 7. The speed of any vehicle approaching or traveling on any structure shall not exceed 10 mph.
 - 8. The roadway surface approaching any structure shall be kept smooth and uniformly graded for 150 feet each side of the structure and shall be maintained to provide a uniform transition onto the structure.
 - 9. A cover of 6 inches $\pm$ 1 inch shall be placed and maintained on the decks of all structures. Cover material shall not include rocks of diameter greater than 2 inches.
- D. The limitations specified in items 2, 3, 4, 5, 6, 7, 8, and 9 above may be waived for all reinforced concrete box culverts providing that the depth of fill compacted and in place over the reinforced concrete box culvert is equal to or greater than the distance between inside faces of outside walls measured along center line of roadway. Fill may be placed not to exceed profile grade elevation.
- E. Construction loads greater than legal loads may be carried over structures within the project which have spans of 10 feet to 20 feet only when the Contractor complies with the above Subparagraph C, numbers 3 through 9, inclusive; however, the limitations as set forth in Subparagraph C, numbers 3 through 5, inclusive, may be waived by the Engineer for reinforced concrete box structures which are adequately supported by shoring. The Contractor shall submit Contractor's proposed shoring details and the actual loads and axle spacings to the Engineer for review prior to the planned hauling. Approval will be

based on a review of the shoring details and a physical inspection of the shoring complete and in place.

- F. The Engineer shall make sufficient checks to satisfy Engineer that the Contractor is complying with all limitations, and any violation shall result in denying the Contractor use of the structure until the violation has been corrected to the satisfaction of the Engineer.
- G. The provision that the Contractor may haul construction loads greater than legal loads on new structures shall not relieve the Contractor of Contractor's responsibility for all damage caused by Contractor's hauling equipment.
- H. The Engineer may, for the protection of the traveling public, establish speed limits on or adjacent to the project. Such limitations of speed shall be strictly observed by the Contractor.

105.14 MAINTENANCE DURING CONSTRUCTION

- A. The Contractor shall maintain the work during construction and until the project is accepted, except as provided for in **Subsections 104.04, "Maintenance of Traffic," and 107.15, "Relief from Maintenance and Responsibility."** This maintenance shall constitute continuous and effective work prosecuted day by day, with adequate equipment and forces to the end that the roadway and structures are at all times, to be kept in a condition satisfactory to the Engineer.
- B. In the case of a contract for the placing of a course upon a course or subgrade previously constructed, the Contractor shall maintain the previous course or subgrade during all construction operations.
- C. Except as provided for in **Subsections 104.04, "Maintenance of Traffic," and 107.15, "Relief from Maintenance and Responsibility,"** all costs of maintenance work during construction and before the project is accepted shall be included in the unit prices bid on the various pay items and the Contractor will not be paid an additional amount for such work.
- D. The Contractor shall maintain a temporary AC patch over backfilled pipe trenches, subject to traffic, during the course of the project to the satisfaction of the Engineer.
 - 1. The temporary patch shall be permanently repaired or removed as soon as the Contractor's operations allow. Temporary asphalt patching will not be allowed to remain longer than 30 calendar days before permanent paving is placed.
 - 2. Should areas of temporary pavement fail and become hazardous, the Contractor shall repair at the Engineer's direction and at the Contractor's expense.

105.15 FAILURE TO MAINTAIN ROADWAY OR STRUCTURE

- A. If the Contractor, at any time, fails to comply with the provisions of **Subsection 105.14, "Maintenance During Construction,"** the Engineer will immediately notify the Contractor in writing of such noncompliance. If the Contractor fails to remedy unsatisfactory maintenance within 24 hours after receipt of such notice, the Engineer may immediately proceed to maintain the project, and the entire cost of this maintenance will be deducted from money due or to become due the Contractor.
- B. If a condition develops that is dangerous to public safety in the opinion of the Engineer, such condition may be immediately remedied with whatever means is available and the cost of this maintenance will be deducted from money due or to become due to the Contractor.

105.16 FINAL ACCEPTANCE

- A. Upon due notice from the Contractor of presumptive completion of the entire project, the Engineer will make an inspection. Upon receipt of Record Drawings, and if all construction and final cleanup provided for and contemplated by the contract are found completed to Engineer's satisfaction, ~~that the~~ inspection shall constitute the final inspection and the Engineer will so advise the governing body or commission. ~~who will notify the~~ Contractor will be notified in writing of the acceptance of the contract as of the date of the final inspection. Such notice will not be given to the board or commission until all work, including required Record Drawings has been completed to the satisfaction of the Engineer.

105.17 CLAIMS FOR ADJUSTMENT AND DISPUTES

- A. If, in any case, the Contractor deems that additional compensation is due Contractor for work or material not clearly covered in the contract or not ordered by the Engineer as extra work as defined herein, the Contractor shall notify the Engineer in writing of Contractor's intention to make claim for such additional compensation before Contractor begins the work on which Contractor bases the claim. If such notification is not given, and the Engineer is not afforded proper facilities by the Contractor for keeping strict account of actual cost as required, then the Contractor hereby agrees to waive any claim for such additional compensation. Such notice by the Contractor, and the fact that the Engineer has kept account of the cost as aforesaid, shall not in any way be construed as proving or substantiating the validity of the claim. If the claim, after consideration by the Engineer, is found to be just, it will be paid as extra work as provided herein for "Force Account" work. Nothing in this subsection shall be construed as establishing any claim contrary to the terms of ***Subsection 104.02, "Increased or Decreased Quantities and Change in Character of Work."***
- B. For all claims, the Contractor shall certify in writing that the claim is made in good faith, that the supporting data are accurate and complete to the best of Contractor's knowledge and belief, and that the amount requested accurately reflects the Contract adjustment for which the Contractor believes the Contracting Agency is liable. Subcontractor claims shall not be considered except as submitted by the Contractor as the Contractor's claims.
- C. Any controversy or claim arising out of or relating to this contract which cannot be resolved by mutual agreement shall be settled by arbitration in accordance with the Rules of the American Arbitration Association.

SECTION 106

CONTROL OF MATERIALS

106.01 SOURCE OF SUPPLY AND QUALITY REQUIREMENTS

- A. The Contractor shall furnish all materials required to complete the work, except materials that are designated in the Special Provisions to be furnished by the Contracting Agency as specified in **Subsection 106.11, "Contracting Agency Furnished Materials."**
- B. No materials or supplies under this contract shall be purchased by the Contractor or by any subcontractor subject to any chattel mortgage, conditional sale contract or other security interest, or other agreement by which an interest is retained by the seller. The Contractor warrants that Contractor has good title to all materials and supplies used by the Contractor in the work, free from all liens, claims, or encumbrances.
- C. Only materials conforming to the requirements of the specifications shall be incorporated in the work except as provided in **Subsection 105.03, "Conformity with Plans and Specifications."**
- D. The materials furnished and used shall be new, except as may be provided elsewhere in these specifications, on the plans or in the Special Provisions. The materials shall be manufactured, handled, and used in a workmanlike manner to ensure completed work in accordance with the plans and specifications.
- E. The Contractor shall furnish the Engineer a list of the Contractor's sources of materials. The list shall be submitted to the Engineer prior to any official "Notice to Proceed" and in sufficient time to permit proper inspecting and testing of materials to be furnished from such listed sources in advance of their use.
- F. The listings of materials that are posted on the Interagency Quality Assurance Committee (IQAC) web page are automatically considered a qualified source. However, this does not remove the responsibility of the Contractor to provide inspection and testing on the project as specified herein. The address for the IQAC webpage is:
http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx
- G. If it is found after trial that sources of supply for previously approved materials do not produce uniform and satisfactory products, or if the product from any source proves unacceptable at any time, which includes IQAC listed materials, the Contractor shall furnish satisfactory materials from other sources.
- H. The Contractor shall furnish without charge such samples as may be required by the Engineer. The primary inspection and testing shall be made by the Contractor or the Contractor's designated representative, with Engineer oversight. However, it is understood that such inspections and tests, if made at any point other than the point of incorporation in the work, in no way shall be considered as a guarantee of acceptance of such materials nor of continued acceptance of material presumed to be similar to that upon which inspections and tests have been made.
- I. Manufacturer's warranties, guarantees, instruction sheets, and parts lists, which are furnished with certain articles or materials incorporated in the work, shall be delivered to the Engineer before acceptance of the completed contract.
- J. Contractor's reports and records of inspections made and tests performed shall be submitted to the Engineer as required in these specifications. The Engineer's inspection

and testing records, when available at the site of the work, may be examined by the Contractor.

106.02 LOCAL MATERIALS

- A. Local material is defined as rock, sand, gravel, earth, or other mineral material, other than local borrow or selected material, obtained or produced from sources in the vicinity of the work specifically for use on the project. Local material does not include materials obtained from established commercial sources.
- B. Local materials shall be furnished by the Contractor from any source the Contractor may elect, except when a mandatory source is designated in the Special Provisions.
- C. Aggregates for base, surface, and concrete may be the products of approved commercial producers, provided they meet specification requirements.
- D. The furnishing of local materials from any source is subject to the provisions of **Subsection 102.05, "Examination of Plans, Specifications, Contract Documents, and Site of Work,"** and **Subsection 106.03, "Possible Local Material Sources."** Material deposits shall not be excavated at locations where their resulting scars will present an unsightly appearance from any street or highway, unless such excavation is approved in writing by the Engineer.
- E. Generally, local material deposits will not be approved if located within 1,000 feet of right-of-way line. In any case the Contractor's pit operations shall not encroach within 25 feet of the right-of-way. Payment will not be made on material obtained in violation of these provisions.
- F. The Contractor shall, at no additional cost to the Contracting Agency, make any and all arrangements necessary for hauling over local, public, or private roads or property from any source. Full compensation for furnishing all labor, materials, tools, equipment, and incidentals; for doing all the work involved in conforming to the provisions in this subsection; and for furnishing and producing materials from any source shall be considered as included in the price paid for the contract item of work involving such material and no additional compensation will be allowed.
- G. The Contractor or the Contractor's representative shall attest to the content of the submitted materials that have been reviewed against the Contract Documents, and that the materials are in compliance thereto. Submitted materials that are to be evaluated as "Or Equal" or "Substitution" shall include sufficient information to enable the Engineer to make the determination for approval.

106.03 POSSIBLE LOCAL MATERIAL SOURCES

- A. If the Contractor desires to use materials from local sources other than those described in **Subsection 102.05, "Examination of Plans, Specifications, Contract Documents, and Site of Work,"** the Contractor shall, at no additional cost to the Contracting Agency, acquire the necessary right to take material and shall obtain all other necessary permits and approvals and shall comply with all the requirements and stipulations in effect by other governing agencies having jurisdiction over the area, and pay all costs involved, including any which may result from an increase in length of haul. All costs of exploring and developing, including inspection and testing, such alternate sources shall be borne by the Contractor and the use of material from such sources will not be permitted until representative samples taken by the Engineer have been approved and written authority issued for the use thereof.

- B. The Contractor's attention is especially directed to Title 43, "Code of Federal Regulations," Part 23, "Surface Exploration, Mining and Reclamation of Lands," which pertains to all exploration, developing, and obtaining material from said alternate deposits located upon land under the jurisdiction of the Bureau of Land Management.
- C. Where the Contracting Agency has made arrangements with owners of land in the vicinity of a project for obtaining material from an owner's property, such arrangements are made solely for the purpose of providing all bidders an equal opportunity to obtain material from such property. Bidders or contractors may, upon written request, inspect the documents evidencing such arrangements between property owners and the Contracting Agency. The Contractor may, if the Contractor so elects, exercise any rights that have been obtained, which may be exercised by a Contractor under such arrangements, subject to and upon the conditions hereinafter set forth.
- D. Such arrangements are not a part of the contract and the Contracting Agency assumes no responsibility to the bidder or Contractor whatsoever in respect to the Contracting Agency's arrangements made with the property owner to obtain materials therefrom and that the Contractor shall assume all risks in connection with the use of such property, and there is no warranty or guarantee, either expressed or implied, as to the quality or quantity of materials that can be obtained or produced from such property or the type or extent of processing that may be required in order to produce material conforming to the requirements of the specifications.
- E. In those instances in which the Contracting Agency has designated optional or mandatory local material sources in the Special Provisions, this may include the documents setting forth the arrangements made with some of the property owners for obtaining material from such owners' properties. The inclusion of such documents therein shall not in any respect operate as a waiver of any of the provisions in this section concerning said documents.
- F. The bidder or Contractor is cautioned to make such independent investigation and examination as the bidder or Contractor deems necessary to satisfy bidder or Contractor as to the quality and quantity of materials available from such property, the type and extent of processing that may be required in order to produce material conforming to the requirements of the specifications and the rights, duties, and obligations acquired or undertaken under such an arrangement with the property owner.
- G. Notwithstanding that the Contractor may elect to obtain materials from any such property owner's property, no material may be obtained from such property unless the Contractor has first either:
 - 1. Executed a document that will guarantee to hold such owner harmless from all claims for injury to persons or damage to property resulting from the Contractor's operations on the property owner's premises and also agreed to conform to all other provisions set forth in the arrangement made between the Contracting Agency and the property owner. Said document will be prepared by the Engineer for execution by the Contractor, or
 - 2. Entered into an agreement with the owner of the material source on any terms mutually agreeable to the owner and the Contractor, provided that the Contractor shall furnish to the Engineer a release, in a form satisfactory to the Engineer, executed by the owner, relieving the Contracting Agency of any and all obligations under the Contracting Agency's arrangements with the owner.
- H. If the Contractor elects to obtain material under G.1, the use of such site shall be subject to the terms, conditions, and limitations of the arrangement made between the property

- owner and the Contracting Agency and the Contractor shall pay such charges as are provided for in the arrangement made by the Contracting Agency with the property owner.
- I. If the Contractor elects to obtain material under G.2, the Contractor shall pay such charges as are provided for in the agreement between the owner and the Contractor.
 - J. Unless otherwise provided and before execution of the contract, the Contractor shall submit written evidence that the owner of the material source is satisfied that the Contractor has satisfactorily complied with the provisions of either (a), the arrangement between the Contracting Agency and the owner, or (b), the agreement between the owner and the Contractor as the case may be.
 - K. Where the Contracting Agency has obtained the right to remove materials from lands owned or controlled by the U.S. Government, by withdrawal or otherwise, and these areas are set forth as optional or mandatory local material sources in the Special Provisions, the Contractor on the project may enter and remove materials for use on subject project only without further permission. The Contractor may not enter on or remove materials from any other areas withdrawn or otherwise obtained by the Contracting Agency from the U.S. Government which are not specifically designated for the project without prior written approval from the Contracting Agency.
 - L. Should the Contractor enter upon any of the areas withdrawn or otherwise obtained by the Contracting Agency from the U.S. Government, it shall be the Contractor's responsibility to determine the rights of others in the area. The Contractor shall not encroach on easements of others without their written permission and shall assume the responsibility for any damages due to the Contractor's entering said area. In addition, the Contractor shall be bound by the terms, conditions, and reservations contained in the approved application for withdrawal.
 - M. Full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in furnishing and producing specified materials from possible local material sources, including the construction of any access roads or fences and any clearing, grubbing, and stripping of material sources, and all processing of whatever nature and extent required, shall be considered as included in the price paid for the contract item of work involving such material and no additional compensation will be allowed.

106.04 SAMPLES AND TESTS

- A. Sampling for final acceptance of materials will be as required in the appropriate specifications sections, contract special provisions, and in general shall comply with the AASHTO requirements, where applicable, and with the following sampling criteria:
 - 1. Aggregates for roadmix bituminous mixtures (including base or surface) will be sampled after the material has been placed on the roadbed and processed and prior to adding the bituminous binder.
 - 2. Aggregate for plantmix bituminous open-graded will be sampled from the laydown machine, or by "belt-cut" sample at the production plant at the Engineer's discretion.
 - 3. Aggregate for screenings will be sampled from the loaded truck just prior to placing, or by "belt-cut" sample at the production plant at the Engineer's discretion.
 - 4. Aggregate for plantmix bituminous mixtures (base or surface) will be sampled for acceptance behind the paver. Samples for plasticity tests will be taken at the bins.

5. Sampling of bituminous materials, intended for use in prime, tack or seal coats, surface treatments, and base, binder, or surface course mixtures shall be done after the bituminous material has arrived at job destination and before or at the time of unloading the materials.
 - a. Two samples shall be taken from each railroad tank car or truck transport of material by the Contractor or the Contractor's designated representative under the observation of and complying with the requirements ~~of AASHTO T-40~~ and in a manner approved by the Engineer. Where delivery is made in smaller hauling units than those cited above such as a distributor, or where the contents of a storage tank are sampled, the required 2 samples shall be taken to represent a maximum of 10,000 gallons. The Contractor shall take the samples during the established job working hours, unless arrangements are made for a representative of the Contracting Agency to witness the taking of the samples at another time.
 - b. All sampling devices and sample containers shall be furnished by the Contractor. Immediately after filling the sample container, it shall be tightly sealed, properly marked for identification, and presented to the Engineer.
 - c. One of the 2 samples, taken from each load, shall be submitted to the Contractor's Material Source laboratory for testing and the other sample retained by the Engineer. If the first sample tested complies with requirements, the second may be discarded.
 - d. Where less than 80 percent of the asphalt deliveries are used on the project, samples shall be taken just prior to delivery to the mixer. Samples shall be taken for every 25 tons of asphalt delivered to the project.
6. Tests for the aforementioned materials produced under conditions other than contemplated herein shall be taken at the time and place deemed by the Engineer to be most appropriate.
- ~~6-7.~~ All field and laboratory testing technicians shall be Nevada Alliance for Quality Transportation Construction (NAQTC) certified, including ACI certification. Information regarding training, examinations and certification is available from the Nevada T2 Center/257, NAQTC, University of Nevada, Reno, 1664 N. Virginia Street, Reno, Nevada, 89557-0179.

106.05 CERTIFICATE OF COMPLIANCE

- A. The Engineer may permit the use of certain materials or assemblies prior to sampling and testing if accompanied by a Certificate of Compliance stating that the materials involved comply in all respects with the requirements of the specifications. The certificates shall be signed by the manufacturer of the material or the fabricator of assembled materials. A Certificate of Compliance shall be furnished with each lot of material delivered to the work and the lot so certified shall be clearly identified in the certificate with attached applicable test results for that lot in accordance with the specification section.
- B. All materials used on the basis of a Certificate of Compliance may be sampled and tested at any time. The fact that material is used on the basis of a Certificate of Compliance shall not relieve the Contractor of responsibility for incorporating material in the work which conforms to the requirements of the plans and specifications and any such material not conforming to such requirements will be subject to rejection whether in place or not.

- C. The Contracting Agency reserves the right to refuse to permit the use of material on the basis of a Certificate of Compliance.
- D. The form of the Certificate of Compliance and its disposition shall be as directed by the Engineer.

106.06 CITED SPECIFICATIONS

- A. The Nevada Department of Transportation has developed test methods for testing the quality of materials and work. These test methods are identified by the prefix Nev. followed by the serial number. Copies of individual test methods are available at the Materials Division, Nevada Department of Transportation, Carson City, Nevada.
- B. Whenever a reference is made in the specifications to a test method by Nev. or Cal. number, it shall mean the test method in effect on the date of the advertisement for bid.
- C. Whenever a reference is made in the specifications to a specification or test designation either of ASTM International, AASHTO, federal specifications, or any other recognized national organization, and the number or other identification accompanying the test designation representing the year of adoption or latest revision of the test is omitted, it shall mean the test method in effect on the date of advertisement for bid.
- D. When requested by the Engineer, the Contractor shall furnish, without charge, samples of all materials entering into the work, and no material shall be used prior to approval by the Engineer, except as provided in **Subsection 106.05, "Certificate of Compliance."** Samples of material from local sources shall be taken by or in the presence of the Engineer; otherwise, the samples will not be considered for testing.

106.07 PLANT INSPECTION

- A. The Engineer may inspect the production of material or the manufacture of products at the source of supply. The Contractor and material producer shall assure the Engineer of their cooperation and assistance to perform plant inspection prior to production of materials for the project. The Engineer or the Engineer's authorized representative shall have free entry at all times to such parts of the plant as concerns the manufacture or production of the materials. Adequate facilities shall be furnished free of charge to make the necessary inspection.
- B. It is understood that the Contracting Agency reserves the right to retest all materials prior to incorporation into the work which have been tested and accepted at the source of supply after the same have been delivered and to reject all materials which, when retested, do not meet the requirements of these specifications, or the requirements of the contract documents.

106.08 STORAGE OF MATERIALS

- A. Materials shall be so stored as to ensure the preservation of their quality and fitness for the work. When considered necessary by the Engineer, materials shall be stored in waterproof buildings, placed on wooden platforms or other hard, clean surfaces, and not on the ground, and shall be covered when directed.
- B. Stored materials, even though approved for use before storage, may be inspected prior to their use in the work, and materials shall meet the requirements of the specifications at the time of this proposed use. Stored materials shall be located so as to facilitate their prompt inspection.

- C. Upon approval of the Engineer, that portion of the right-of-way not required for public travel may be used for storage purposes and for placing of the Contractor's plant and equipment, but any additional space required therefor shall be provided by the Contractor at no additional cost to the Contracting Agency. Private or public property shall not be used for storage purposes without written permission of the owner or lessee.
- D. All storage sites shall be restored to their original condition by the Contractor at no additional cost to the Contracting Agency. This shall not apply to the stripping and storing of top soil or to other material salvaged from the work or specifically prescribed under the specifications. Construction materials may not be stored in streets, roads, or highways for more than 5 days after unloading. All materials or equipment not installed or used in the construction within 5 days after unloading shall be stored elsewhere by the Contractor at no additional cost to the Contracting Agency unless the Contractor is authorized additional storage time.
- E. Construction equipment shall not be stored at the work site before its actual use on the work nor for more than 5 days after it is no longer needed on the work unless the Contractor is authorized additional storage time. Time necessary for repair or assembly of equipment may be authorized by the Engineer.
- F. Excavated material, except that which is to be used as backfill in the adjacent trench, may not be stored in public streets, roads, or highways unless otherwise permitted. After placing backfill, all excess material shall be removed immediately from the site.

106.09 HANDLING MATERIALS

- A. All materials shall be handled in such manner as to preserve their quality and fitness for the work.
- B. Aggregates shall be transported from the storage site to the work in tight vehicles so constructed as to prevent loss or segregation of materials after loading and measuring in order that there may be no inconsistencies in the quantities of materials intended for incorporation in the work as loaded, and the quantities as actually received at the place of operation.

106.10 GUIDANCE ANALYSIS OF NONCOMPLYING MATERIALS

- A. In the event of a non-compliance of a produced or placed material, the Contractor is responsible for submitting a recommendation report to the Engineer for the determination of the basis of acceptance of the material by the Engineer based on AASHTO R-9, this section, and/or other industry practices as approved by the Engineer. This report shall be performed by a Nevada Professional Engineer. The receiving of the report by the Engineer does not imply acceptance of the report recommendations.
- B. The policy of the Engineer is that a project shall have been constructed "... in reasonably close conformity with the approved plans and specifications..." to be eligible for full payment of the material and installation. However, there will be instances when test results, as a result of the above noted variability may indicate apparent nonconformance to the specification limits, yet the construction product may be acceptable for the use intended at full or reduced pay. In these cases, an analysis of the materials and/or materials test results will be necessary by the Contractor through a professional engineer before payment is made.
- C. As a general guidance and unless otherwise stipulated in other specification sections or contract Special Provisions, if more than 10 percent of the test values for any construction

product are outside of the applicable specifications, there may be a question of "reasonably close conformity." In these cases, an analysis of the test values should be made to determine the magnitude and extent of the nonconforming materials.

106.11 CONTRACTING AGENCY FURNISHED MATERIAL

- A. The Contractor shall furnish all materials required to complete the work, except those specified to be furnished by the Contracting Agency. Material furnished by the Contracting Agency will be delivered or made available to the Contractor at the points specified in the Special Provisions.
- B. The cost of handling and placing all materials after they are furnished to the Contractor shall be considered as included in the contract price for the item in connection with which they are used.
- C. The Contractor will be held responsible for all material furnished to the Contractor, and deductions will be made from any money due to the Contractor to make good any shortages and deficiencies, from any cause whatsoever, and for any damage which may occur after such delivery and for any demurrage charges. The responsibility by the Contractor includes any project inspection and testing that is required in these specifications.

SECTION 107

LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

107.01 LAWS TO BE OBSERVED

- A. The Contractor shall keep fully informed of all federal and state laws, all local bylaws, ordinances, and regulations, and all orders and decrees of bodies or tribunals having jurisdiction or authority, which in any manner affect those engaged or employed on the work, or which in any way affect the conduct of the work. The Contractor shall at all times observe and comply with all such laws, bylaws, ordinances, regulations, orders, and decrees, and shall protect and indemnify the Contracting Agency and its representative against any claim or liability arising from or based on the alleged violation of any such law, bylaw, ordinance, regulation, order, or decree, whether by the Contractor, the Contractor's employees, or agents.

107.02 PERMITS, LICENSES, AND TAXES

- A. The Contractor shall obtain all permits and licenses, and give all notices necessary and incident to the due and lawful prosecution of the work, including vehicular registration or prorated registration and carrier licensing as applicable. Privilege taxes are in addition to the above fees.

107.03 PATENTED DEVICES, MATERIALS, AND PROCESSES

- A. If the Contractor employs any design, device, material, or process covered by letters of patent or copyright, the Contractor shall provide for such use by suitable legal agreement with the patentee or owner. The Contractor and the surety shall indemnify and save harmless the Contracting Agency, and affected third party, or political subdivision from any and all claims for infringement by reason of the use of any such patented design, device, material or process, or any trademark or copyright, and shall indemnify the Contracting Agency for any costs, expenses, and damages which the Contracting Agency may be obliged to pay by reason of any alleged infringement, at any time during the prosecution or after the completion of the work.

107.04 RESTORATION OF SURFACES OPENED BY PERMIT

- A. The right to construct or reconstruct any utility service in the public right-of-way, or to grant permits for same, at any time, is hereby expressly reserved by the Contracting Agency or the proper authorities of the municipality or other political subdivision in which the work is done and the Contractor shall not be entitled to any damages either for the digging up of the street or for any delay occasioned thereby.
- B. Any individual, firm, or corporation wishing to make an opening in the highway or street must secure a permit from the proper authority. The Contractor shall allow parties bearing such permits, and only those parties, to make openings in the highways or streets. The Contractor shall, when ordered by the Engineer, make in an acceptable manner, all necessary repairs due to such openings, and such necessary work will be paid for as extra work, or as provided in these specifications, and will be subject to the same conditions as original work performed.
- C. The Contracting Agency, the Contractor, and each of such workmen, contractors, and others shall coordinate their operations and cooperate to minimize interference.

- D. The Contractor shall absorb in the Contractor's bid all costs involved on the Contractor's part as a result of coordinating the Contractor's work with others. The Contractor will not be entitled to additional compensation from the Contracting Agency for damages resulting from such simultaneous, collateral, and essential work. If necessary to avoid or minimize such damage or delay, the Contractor shall redeploy the Contractor's work force to other parts of the work.
- E. Should the Contractor be delayed by the Contracting Agency, and such delay could not reasonably have been foreseen and prevented by the Contractor, the Engineer will determine the extent of the delay, the effect of the delay on the project as a whole, and recommend to the Board any time extension indicated.

107.05 BLANK

107.06 SANITARY PROVISIONS

- A. The Contractor shall provide and maintain in a neat, sanitary condition, such accommodations for the use of the Contractor's employees as may be necessary to comply with the requirements and regulations of the Southern Nevada Health District and of other bodies or tribunals having jurisdiction thereover. The Contractor shall commit no public nuisance.

107.07 TRAFFIC AND ACCESS

- A. The Contractor's operations shall cause no unnecessary inconvenience. The access right of the public shall be considered at all times. Unless otherwise authorized, traffic shall be permitted to pass through the work, or an approved detour shall be provided.
- B. Safe and adequate pedestrian and vehicular access shall be provided and maintained to fire hydrants, commercial and industrial establishments, churches, schools, parking lots, service stations, motels, fire and police stations, hospitals, and establishments of similar nature. Access to these facilities shall be continuous and unobstructed unless otherwise approved by the Engineer.
- C. Safe and adequate pedestrian zones and pedestrian crossings of the work at intervals not exceeding 300 feet shall be maintained unless otherwise approved by the Engineer.
- D. Safe and adequate access shall be maintained to existing bus or transit stops throughout duration of road construction in accordance with the following minimum requirements:
 1. Unless otherwise specified in the Special Provisions, no public bus or transit stop shall be temporarily closed without the written consent of the Regional Transportation Commission of Southern Nevada (RTC) General Manager or the RTC General Manager's designee. The Contractor shall not close down any two consecutive bus stops on routes for buses traveling in the same direction. The RTC shall be notified at least 10 working days prior to the proposed temporary closure of any bus or transit stop, including those listed in the Special Provisions.
 2. No bus stops at transfer points shall be closed during construction. Bus stops at transfer points can, however, be temporarily relocated with the approval of the RTC.
 3. Temporary bus stops may be considered upon approval by the RTC. The Contractor may call the RTC with any questions. A map of bus stop locations may be obtained from the RTC. If bus or transit stop is temporarily relocated, the existing bus or transit stop sign panels shall be relocated to temporary bus or transit stops and shall remain until temporary stop is removed. Temporary relocation of

sign panels shall conform to **Subsection 627.03.05, "Relocation."** The Contractor shall relocate existing bus-stop signs at designated areas into existing sidewalk, and the sign relocation shall be incidental to other items of work.

4. The Contractor shall maintain access that is in conformance to the requirements of the Americans with Disabilities Act to and from bus or transit stops which remain open at all times during construction.
- E. Vehicular access to residential driveways shall be maintained to the property line except when necessary construction precludes such access for reasonable periods of time. If backfill has been completed to such extent that safe access may be provided, and the street is opened to local traffic, the Contractor shall immediately clear the street and driveways and provide and maintain access.
- F. The Contractor shall cooperate with the various parties involved in the delivery of mail and the collection and removal of trash and garbage to maintain existing schedules for these services.
- G. Grading operations, roadway excavation, and fill construction shall be conducted by the Contractor in a manner to provide a satisfactory surface for traffic. When rough grading is completed, the roadbed surface shall be brought to a smooth, even condition satisfactory for traffic.
- H. Unless otherwise authorized, work shall be performed in only one half the roadway at one time. One half shall be kept open and unobstructed until the opposite side is ready for use. If one half a street only is being improved, the other half shall be conditioned and maintained as a detour.
- I. The Contractor shall absorb in the Contractor's bid all costs for the above requirements.
- J. The Contractor shall comply with all applicable state, county, and city requirements for closure of streets. Traffic work zone technicians on the project shall be certified in the work zone traffic control at least at the "Technician" level by ATSSA, IMSA, or NICET. The Contractor shall provide barriers, guards, lights, signs, temporary bridges, flagmen, and watchmen, advising the public of detours and construction hazards. The Contractor shall also be responsible for compliance with additional public safety requirements that may arise during construction. The Contractor shall furnish and install, and upon completion of the work, promptly remove all temporary signs and warning devices.
- K. At least 48 hours in advance of closing, partially closing, or reopening any street, alley, or other public thoroughfare, the Contractor shall notify the Police, Fire, Traffic and Engineering Departments having jurisdiction and comply with their requirements, and notify the Regional Transportation Commission of Southern Nevada. Deviations shall first be approved in writing by the Engineer.
- L. All costs involved shall be absorbed in the Contractor's bid. All barricades, warning signs, lights, temporary signals, and other protective devices shall conform with the Traffic Control Plans for Highway Work Zones for the Clark County Area and the current edition of the Manual on Uniform Traffic Control Devices.

107.08 RELATIONS WITH RAILROADS

- A. **Definitions:** The following definitions shall apply to the terms as herein used:
 1. **Railroad:** The railway or railroad company whose tracks are crossed or whose property is adjacent to the work or upon whose property the work is performed.

2. **Chief Engineer:** The Chief Engineer of the railroad or the Chief Engineer's authorized representatives.
3. **Railroad Crossing:** A crossing at grade of the tracks of a railroad and the highway.
4. **Grade Separation:** A permanent structure to effect the separation of grade between the highway and the railroad.

B. Work or Operations:

1. Work or operations on grade separations, railroad crossings, or upon railroad property shall be subject to inspection by the Chief Engineer and shall be conducted and performed in a manner satisfactory to the Chief Engineer.
2. Construction operations shall be so arranged and conducted as to ensure safe and uninterrupted operation of the railroad traffic. The Contractor shall be responsible for any damages which result either directly or indirectly from the Contractor's operations.
3. The Contractor shall notify the Chief Engineer in writing, at least 48 hours before starting any work in the proximity of the tracks, setting forth specifically the time at which it is planned to start such work.
4. Unless otherwise provided, the Contractor shall not pile or store any material, or park or use Contractor's equipment closer than 10 feet from the centerline of the tracks.
5. The track zone shall be kept clean of all loose material or debris at all times. The Contractor shall be responsible for any fouling of railroad ballast resulting from sandblasting and painting operations and shall reimburse the railroad for the replacement of all ballast so fouled.
6. In advance of any blasting, the Contractor shall notify the Chief Engineer in order that proper flagging protection may be provided by the railroad. Excavations in the proximity of the tracks shall be sheeted in a manner satisfactory to the Chief Engineer and plans therefor shall be submitted to and approved by the Chief Engineer before any such excavation is commenced.
7. The Contractor shall make arrangements with the railroad for crossing railroad tracks at locations other than existing public crossings and shall bear all costs relative thereto.
8. The Contractor shall submit detail plans of falsework and of forms for track spans and piers or abutments to the Chief Engineer and no work thereon shall be commenced unless and until such plans have been approved by the Chief Engineer. Falsework plans thus approved shall not be deviated from without permission of the Chief Engineer. The temporary vertical and horizontal clearances specified by the Chief Engineer in approving the plans shall be maintained at all times. In the case of impaired vertical clearances above the top of rail, the railroad shall have the option to install telltales, or other such protective devices the railroad deems necessary, for the protection of trainmen or rail traffic.
9. The Contractor shall comply with the rules and regulation of the railroad with respect to the Contractor's work or operation on or adjacent to railroad property. The Contractor shall arrange with the railroad for the services of such qualified railroad employees as the Chief Engineer may prescribe to protect and safeguard the railroad's property, engines, trains, and cars. The costs incurred for the services of

such railroad employees as may be prescribed by the Chief Engineer for necessary safeguard and protection and the costs of installing telltales or other protective devices in the case of impaired vertical clearance, shall be borne by the Contractor without expense to the Contracting Agency or railroad. Payment for such services, including compensation, insurance, vacation and holiday time, railroad retirement and unemployment taxes, health and welfare, accounting and billing charges, may be paid by the Contracting Agency directly to the railroad and the amount thereof shall be deducted by the Contracting Agency from money due or which may become due the Contractor under the awarded contract. Rates of pay for qualified railroad employees will be the railroad's rates for the various classes of labor customarily used and in effect at the time the work is performed. The Contractor's reimbursement for personnel and protective devices required as set forth herein shall be considered as included in the contract unit prices bid for other items of work.

10. Upon completion of the work covered by the awarded contract to be performed by the Contractor upon railroad's property, the Contractor shall promptly remove from the railroad's property all tools, equipment, and other materials, whether brought upon said property by the Contractor or any subcontractor, and shall cause said property to be left in a clean and presentable condition.

C. Work or Operations Performed by Railroad:

1. The railroad may undertake certain work or operations incident to the project which are the subject of an agreement between the Contracting Agency and the railroad. Details of such work or operations will be set forth in the Special Provisions and the Contractor shall discuss such items with the Chief Engineer in order to develop a plan whereby the Contractor and the railroad accomplish the work or operations in their logical sequence and order.
2. Movement or adjustment of telephone, telegraph, or signal facilities owned, operated, or maintained by the railroad and not otherwise provided for on the plans or in the Special Provisions shall be at the cost and expense of the Contractor.

- D. **Insurance:** The Contractor shall provide and maintain during the effective life of the awarded contract such special or additional insurance as is required by **Subsection 107.11, "Responsibility for Damage Claims,"** herein. The Contractor shall furnish such evidence as may be required that such insurance has been provided.
- E. **Qualification:** As a prerequisite to award, the Contractor shall be satisfactory as to responsibility to perform work upon the railroad's property.
- F. **Reference:** The provisions of **Subsection 624.03.02, "Flaggers," Subsection 624.03.03, "Pilot Cars," Subsection 107.11, "Responsibility for Damage Claims,"** and the Special Provisions shall inure directly to the benefit of the railroad.

107.09 LIABILITY INSURANCE

A. Contractor's Public Liability and Property Damage Liability Insurance:

1. The Contractor shall provide and maintain during the effective life of the awarded contract, regular Contractor's Public Liability and Property Damage Liability Insurance, the limits for which may be set by the Special Provisions to protect the Contractor and all of the Contractor's construction subcontractors from claims for personal injury, accidental death, and damage to property, which may arise from operations under said contract, whether such operations be by the Contractor or by

such subcontractor or by anyone directly or indirectly employed by either of them. The Successful Bidder shall furnish the Contracting Agency a policy or certificate of liability insurance in which the Contracting Agency shall be named insured or be named as an additional insured with the Contractor. The Successful Bidder shall also furnish a Certificate of Workman's Compensation Insurance, Nevada Industrial Commission.

2. Whenever construction operations covered under said contract are to be performed upon or in proximity to railroad property, the Contractor's Public Liability and Property Damage Insurance shall provide for limits of coverage not less than specified in the Railroad Protective Insurance Endorsement appended to the Special Provisions.
3. The Contractor shall furnish the Contracting Agency with 1 certified copy of all insurance required under this paragraph.

B. Railroad's Protective Public Liability and Property Damage Insurance:

1. In all cases where construction operations covered by the awarded contract are to be performed upon or adjacent to the property of the railroad, the Contractor shall furnish evidence to the Contracting Agency that, with respect to the operations the Contractor or any of the Contractor's subcontractors perform, the Contractor has provided for and in favor of the railroad a policy of Public Liability and Property Damage Insurance, to which is attached an endorsement, in the same form and with the same limits of coverage as the Railroad Protective Insurance Endorsement appended to the Special Provisions.
2. Such insurance shall apply only to that portion of the project upon or adjacent to the railroad property.
3. Railroad's Protective Public Liability and Property Damage Insurance shall be subject to approval by the railroad before any work is commenced on or adjacent to the railroad property.
4. Such insurance shall be carried, and the premiums therefor paid by the Contractor until all work required to be performed under the terms of said contract is satisfactorily completed as evidenced by the formal acceptance of the Contracting Agency and thereafter until all said tools, equipment, and materials have been removed from the property of the railroad and such property left in a clean and presentable condition. The insurance shall be non-cancelable and non-alterable for any cause whatsoever (including failure to pay premiums) either by the Contractor or by the insurance company without 30 days' written notice to the railroad and the Contracting Agency. In the event such insurance is canceled as herein provided, the Contractor shall provide other insurance, subject to the same conditions as provided herein, which shall be effective as of the day of such cancellation and cover the unexpired period of the term herein required. The Contractor shall furnish the Contracting Agency at the time of execution of said contract, 3 copies of each policy to which is attached an endorsement the same as the Railroad Protective Insurance Endorsement appended to the Special Provisions. Two copies of each of such policies shall be forwarded by the Contracting Agency to the Chief Engineer for the railroad's approval.

107.10 EXPLOSIVES

- A. Explosives may be used only when authorized in writing by the Engineer, or as otherwise stated in the Special Provisions. Explosives shall be handled, used, and stored in accordance with all applicable regulations.
- B. The Engineer's approval of the use of explosives shall not relieve the Contractor from the Contractor's liability for claims caused by the Contractor's blasting operations.
- C. All explosives shall be stored in a secure manner in compliance with all laws and ordinances, and all such storage places shall be clearly marked. Where no local laws or ordinances apply, storage shall be provided satisfactory to the Engineer and in general not closer than 1,000 feet from the road or from any building or camping area or place of human occupancy.
- D. The Contractor shall notify each public utility company having structures or pipelines in proximity to the site of the work of the Contractor's intention to use explosives. Such notice shall be given in writing a week in advance to enable the companies to take such steps as they may deem necessary to protect their property from injury.

107.11 RESPONSIBILITY FOR DAMAGE CLAIMS

- A. The Contractor shall indemnify and save harmless the Contracting Agency, its officers, and its employees from all suits, actions, claims, losses, or expenses of any character brought because of any injuries or damages alleged to have been received or sustained by any person, persons, or property on account of the operations of the Contractor; or on account of or in consequence of any neglect in safeguarding the work; or through use of unacceptable materials in constructing the work; or because of any claims or amount recovered under the "Nevada Industrial Insurance Act," or any other law, ordinance, order, or decree; and so much of the money due the Contractor under and by virtue of the contract as may be considered necessary by the Contracting Agency for such purpose, may be retained for the protection of the Contracting Agency; or in case no money is due, the Contractor's surety may be held until all such suits, actions, claims, losses, or expenses for the injuries or damages as aforesaid shall have been settled and suitable evidence to that effect furnished to the Contracting Agency; except that money due the Contractor will not be withheld when the Contractor produces satisfactory evidence that the Contractor is adequately protected by public liability and property damage insurance.
- B. Reimbursement to the Contractor by the Contracting Agency in whole or in part for costs of protecting traffic shall not serve to relieve the Contractor of the Contractor's responsibility as set forth in these specifications.
- C. The Contractor guarantees the payment of all just claims for materials, supplies, and labor and all other just claims against the Contractor or any subcontractor, in accordance with this contract.

107.12 PROTECTION AND RESTORATION OF PROPERTY AND LANDSCAPE

- A. The Contractor shall be responsible for the preservation from injury or damage resulting directly or indirectly from the work under the contract of all public and private property, crops, trees, vegetation, monuments, fences, highway signs and markers, etc., along and adjacent to the project, and shall use every precaution necessary to prevent damage to waterlines, sewers, and other underground structures, to poles, wires, cables, and other overhead structures, whether shown on the plans or not, shall protect carefully from disturbance or damage all land monuments and property marks until the Engineer has

- witnessed or otherwise referenced their location, and shall not remove them until directed. The Contractor shall not willfully or maliciously injure or destroy trees or shrubs, and the Contractor shall not remove or cut trees or shrubs without proper authority.
- B. The Contractor shall be responsible for all damage or injury to property of any character during the prosecution of the work resulting from any act, omission, neglect, or misconduct in the Contractor's manner or method of executing said work, or at any time due to defective work or materials, and such responsibility shall not be released until the project shall have been completed and accepted.
 - C. The Contractor shall be responsible for the preservation of archeological and paleontological objects, including all ruins, sites, buildings, artifacts, fossils, or other objects of antiquity encountered during construction. When such objects are encountered, the Contractor shall immediately cease operations and notify the Engineer that such objects exist. Construction operations shall be rescheduled to avoid the section until the removal of the artifacts or the gathering of historical data has been accomplished by the appropriate authority. When directed by the Engineer, the Contractor shall excavate the site in such a manner as to preserve the artifacts encountered and shall remove them for delivery to the custody of the proper authorities. Such excavation will be considered and paid for in accordance with **Subsection 104.03, "Extra Work."**
 - D. Extension of contract time will be allowed for any delay to the Contractor due to preservation of archeological and paleontological objects.
 - E. When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect or misconduct in the execution of the work, or in consequence of the nonexecution thereof on the part of the Contractor or the Contractor's agents, suppliers, or subcontractors, the Contractor shall restore at no additional cost to the Contracting Agency such property to a condition similar or equal to that existing before such damage or injury was done by repairing, rebuilding, or otherwise restoring as may be directed, or the Contractor shall make good such damage or injury in an acceptable manner. In case of failure on the part of the Contractor to restore such property or make good such damage or injury within 10 days, the Contracting Agency may, upon 48 hours' written notice, proceed to repair, rebuild, or otherwise restore such property as may be deemed necessary and the cost thereof shall be deducted from any money due, or which become due the Contractor under the contract.
 - F. The Contractor shall restrict the movement of the Contractor's vehicles and other construction equipment and personnel to the construction area and designated roads. Every precaution shall be taken to prevent the marking of the natural ground with equipment tracks or other means outside of the staked area and in median areas where it is not required to disturb the existing ground. Where such markings of the natural ground are caused either by the Contractor's equipment, personnel, or operations, the Contractor, at no additional cost to the Contracting Agency, shall eradicate such marks to the satisfaction of the Engineer.
 - G. All roads used for construction operations shall be spaced at least 1,000 feet apart from flat bottom ditches and material deposits, except that such roads may also be located in ditch and dike areas. When roads are located in ditch and dike areas, equipment shall not be allowed to travel outside the area occupied by said ditch or dike, except as provided for in **Subsection 203.03.13, "Channels."** The crossing of median areas shall be at structures or areas approved by the Engineer.
 - H. Where there is a high potential for erosion and subsequent water pollution, the area of erosive land that may be exposed by construction operations at any one time shall be held

to a minimum, and the duration of the exposure of the uncompleted construction to the elements shall be as short as practicable. Erosion control features shall be constructed concurrently with other work and at the earliest practicable time.

- I. Disturbance of the lands and of waters that are outside the limits of the construction as staked is prohibited, except as may be found necessary and approved by the Engineer.

107.13 FIRE PROTECTION

- A. There shall be no open burning unless approval has been given in writing by the Clark County Air Pollution Control Officer and the Engineer has concurred. Before setting any fires whatsoever, the Contractor shall notify the responsible agency having jurisdiction for the area concerned. The Engineer shall have authority to enforce correction of any condition which is, in the Engineer's opinion, unsafe.

107.14 DISPOSAL OF MATERIAL OUTSIDE PROJECT RIGHT-OF-WAY

- A. The Contractor shall make the Contractor's own arrangements for disposal of materials outside the project right-of-way at no additional cost to the Contracting Agency.
- B. When any material is to be disposed of outside the project right-of-way, the Contractor shall first obtain a written permit from the property owner on whose property the disposal is to be made, and the Contractor shall file in writing with the Engineer said permit or the certified copy thereof together with a written release from the property owner absolving the agency of any and all responsibility in connection with the disposal of material on said property.
- C. When material is disposed of as above provided and the disposal location is visible from the project, the Contractor shall dispose of the material in a neat and uniform manner to the satisfaction of the Engineer.
- D. Unless otherwise provided in the Special Provisions, full compensation for all costs involved in disposing of material as specified in this section, including all costs of hauling, shall be considered as included in the price paid for the contract items of work involving such materials and no additional compensation will be allowed therefore.

107.15 RELIEF FROM MAINTENANCE AND RESPONSIBILITY

- A. Upon the written request of the Contractor, or upon order of the Engineer, the Contractor may be relieved of the duty of maintaining and protecting certain portions of the work as described below, which have been completed in all respects in accordance with the requirements of the contract and to the satisfaction of the Engineer, and thereafter except with the Engineer's consent, the Contractor will not be required to do further work thereon. In addition, such action by the Engineer will relieve the Contractor of responsibility for injury or damage to said completed portions of the work resulting from use by the public traffic or from the action of the elements or from any other cause, but not from injury or damage resulting from the Contractor's own operations or from the Contractor's negligence.
- B. Portions of the work for which the Contractor may be relieved of the duty of maintenance and protection as provided in the above paragraph include but are not limited to the following:
 1. A bridge or other structure of major importance.
 2. A complete unit of a traffic control signal system or of a highway or street lighting system.

3. Non-project facilities constructed for other agencies.
- C. However, nothing in this subsection providing for relief from maintenance and responsibility will be construed as relieving the Contractor of full responsibility for making good defective work or materials found at any time before the formal written acceptance of the entire project by the Contracting Agency.

107.16 CONTRACTOR'S RESPONSIBILITY FOR THE WORK AND MATERIALS

- A. Until the acceptance of the contract, the Contractor shall have the charge and care of the work and of the materials to be used therein (including materials for which the Contractor has received partial payment as provided in **Subsection 109.06, "Partial Payments,"** or materials which have been furnished by the agency) and shall bear the risk of injury, loss, or damage to any part thereof by the action of the elements or from any other cause, whether arising from the execution or from the nonexecution of the work, except as provided in **Subsection 107.15, "Relief from Maintenance and Responsibility."**
- B. The Contractor shall rebuild, repair, restore, and make good all injuries, losses, or damages to any portion of the work or the materials occasioned by any cause before its completion and acceptance and shall bear the expense thereof, except as otherwise expressly provided in **Subsection 203.03.11, "Slides and Slipouts,"** and **Subsection 619.05.01, "Payment,"** for Object Markers and Guide Posts, and except for such injuries, losses, or damages as are directly and proximately caused by acts of the federal government or the public enemy. The Contractor shall, at no additional cost to the Contracting Agency, provide suitable drainage for the project and erect such temporary structures as are necessary to protect the work or materials from damage.
- C. The suspension of the work from any cause whatever shall not relieve the Contractor of the Contractor's responsibility for the work and materials as herein specified. If ordered by the Engineer, the Contractor shall, at no additional cost to the Contracting Agency, properly store materials which have been fully or partially paid for and furnished by the Contracting Agency. Such storage by the Contractor shall be on behalf of the Contracting Agency and the Contracting Agency shall at all times be entitled to the possession of such materials, and the Contractor shall promptly return the same to the site of the work when requested. The Contractor shall not dispose of any of the materials so stored except on written authorization from the Engineer.

107.17 CONTRACTOR'S RESPONSIBILITY FOR UTILITY PROPERTY AND SERVICE

- A. At points where the Contractor's operations are adjacent to properties of railroad, telegraph, telephone, and power companies, or are adjacent to or in conflict with other property or utilities, damage to which might result in considerable expense, loss, or inconvenience, work shall not be commenced until all arrangements necessary for the protection thereof have been made.
- B. The Contractor shall not begin any operations which may interfere with or impair the normal service being rendered by public or private utility operations, until such operators have been notified, and shall cooperate with the owners of any underground or overhead utilities in their removal and rearrangements operations in order that these operations may progress in a reasonable manner, and that duplication of rearrangements work may be reduced to a minimum, and that services rendered by those parties will not be unnecessarily interrupted. The Contractor will be held responsible for the protection of the property of public or private utilities within the limits of the work.

- C. In general, the repair and adjustment of street structures such as waterlines, sewers, telephone, telegraph, gas, and electric lines, above or below the ground, will be made by the owners thereof as specified in **Subsection 105.06, "Cooperation with Utilities."** When included in the proposal, the adjustment of sewer manhole frames and covers, inlets and catch basin frames and covers and the like, will be within the Contractor's responsibility. The Contractor shall see that they are adjusted to conform to the lines, grades, and typical cross sections as shown on the plans, or as prescribed, without respect to whether the repairs and the roughing-in work have been performed by the Contractor or others.
- D. Pipes or other construction shall be maintained in continuous service as far as practicable and shall be properly protected and supported. In no case shall interruption of the water service be allowed to exist outside of working hours.
- E. Fire hydrants shall be accessible at all times to the fire department. No material or other obstruction shall be placed closer to a fire hydrant than permitted by ordinances, rules, or regulations, or within 15 feet of the fire hydrant in the absence of such ordinances, rules, or regulations.
- F. The Contractor shall give notice in writing to the proper authorities in charge of streets, gas, water pipes, sewer lines, electric, and other conduits, railroads, poles, manholes, catch basins, and all other property that may be affected by the Contractor's operations, at least 48 hours before breaking ground.
- G. In the event of interruption to water or utility services as a result of accidental breakage, the Contractor shall promptly notify the proper authority. The Contractor shall cooperate with said authority in the restoration of service as promptly as possible.
- H. Attention is directed to **Subsection 105.06, "Cooperation with Utilities."**

107.18 FURNISHING RIGHT-OF-WAY

- A. The Contracting Agency will be responsible for the securing of all right-of-ways shown in the plans. Any exceptions will be indicated in the contract.

107.19 PERSONAL LIABILITY OF PUBLIC OFFICIALS

- A. In carrying out any of the provisions of these specifications or in exercising any power or authority granted to them by or within the scope of the contract, there shall be no liability upon the officers or employees of the Contracting Agency, either personally or as officials of the County or Municipality, it being understood that in all such matters they act solely as agents and representatives of the Political Subdivision.

107.20 NO WAIVER OF LEGAL RIGHTS

- A. The Contracting Agency shall not be precluded or estopped by any measurements, estimate, or certificate made either before or after the completion and acceptance of the work and payment therefor, from showing the true amount and character of the work performed, and materials furnished by the Contractor, nor from showing that any such measurement, estimate, or certificate is untrue or is incorrectly made, nor that the work or materials do not in fact conform to the contract. The Contracting Agency shall not be precluded or estopped, notwithstanding any such measurement, estimate, or certificate, and payment in accordance therewith, from recovering from the Contractor or the Contractor's sureties, or both, such damages as it may sustain by reason of the Contractor's failure to comply with the terms of the contract. Neither the acceptance by the

Contracting Agency, or any representative of the Contracting Agency, nor any payment for or acceptance of the whole or any part of the work, nor any extension of time, nor any possession taken by the Contracting Agency, shall operate as a waiver of any portion of the contract or of any power herein reserved, or of any right to damages. A waiver of any breach of the contract shall not be held to be a waiver of any other or subsequent breach.

107.21 DUST CONTROL

- A. Dust that originates from the Contractor's operations, either inside or outside the right-of-way, shall be controlled at all times by the Contractor in accordance with federal, state, and local laws, ordinances, and regulations at the sole expense of the Contractor.
- B. A permit from the Clark County Air Pollution Officer shall be obtained by the Contractor prior to the start of construction operations.
- C. Reference is made to **Section [637](#), "Pollution Control."**

107.22 VIBRATORY EQUIPMENT OPERATIONS

- A. All construction activities involving vibratory equipment shall be conducted by the Contractor on a performance basis. The Contractor may be required to conduct impact assessment tests of the Contractor's vibratory equipment prior to initiation or during construction. The frequency and amplitude of the vibratory equipment shall be calibrated and used to measure ground velocity for conformance to the current regulatory limit of 0.5 inch per second peak ground velocity at the nearest affected structure. The measurements shall comply with the recommendations of the *Blasting Guidance Manual*, published in 1987 by the Office of Surface Mining and Enforcement.

SECTION 208

TRENCH EXCAVATION AND BACKFILL

01DESCRIPTION

208.01.01 GENERAL

- A. This work shall consist of the excavation and backfill of trenches for the accommodation of substructures including, but not limited to electrical conduits, telephone conduits, television cable, traffic signal conduits, gas lines, sewer lines, water lines, and storm drains except where governed by utility agency specifications. These other agencies are responsible for the trench to the top of subgrade (bottom of the pavement section).
- B. When the terms "Backfill" or "Trench Backfill" are used herein, they shall be construed to mean one or more of the types of backfill specified below under "Materials."
- C. The designing engineer shall comply with the intent of the pipe material as defined as either rigid or flexible in conformance with the AASHTO LRFD Bridge Design and Construction Specifications and this Section. Special attention shall be given to the sidewall material properties as this section assumes a minimum AASHTO A1 or A3 material. Other sidewall material type shall be given special consideration for minimum trench widths, the use of Controlled Low Strength Materials (CLSM), or other critical processes that would affect the pipe ability to withstand the load and shall also be noted on the plans and specifications for the project.
- D. The type of pipe and applicable installation requirement (trench and embankment) to be used as demonstrated by the design and approved by the Agency Engineer shall be clearly noted on the drawings and specifications along with installation procedures that may differ from this section.
- E. Quality control field inspection and testing requirements including frequency shall be in accordance with Contracting Agency requirements.

208.01.02 DEFINITIONS

- A. **Foundation:** Over-excavation and backfill of the foundation is required only when the native trench bottom does not provide a firm-working platform for placement of the pipe bedding material.
- B. **Bedding:** In addition to bringing the trench bottom to required grade, the bedding levels out any irregularities and ensures uniform support along the length of the pipe.
- C. **Haunch Zone:** The backfill under the lower half of the pipe (haunches) distributes the superimposed loadings.
- D. **Initial Zone:** The backfill from the springline to the top of the pipe zone provides the primary support against lateral pipe deformation for flexible pipe.
- E. **Final Zone:** Backfill above the pipe zone to the top of subgrade.

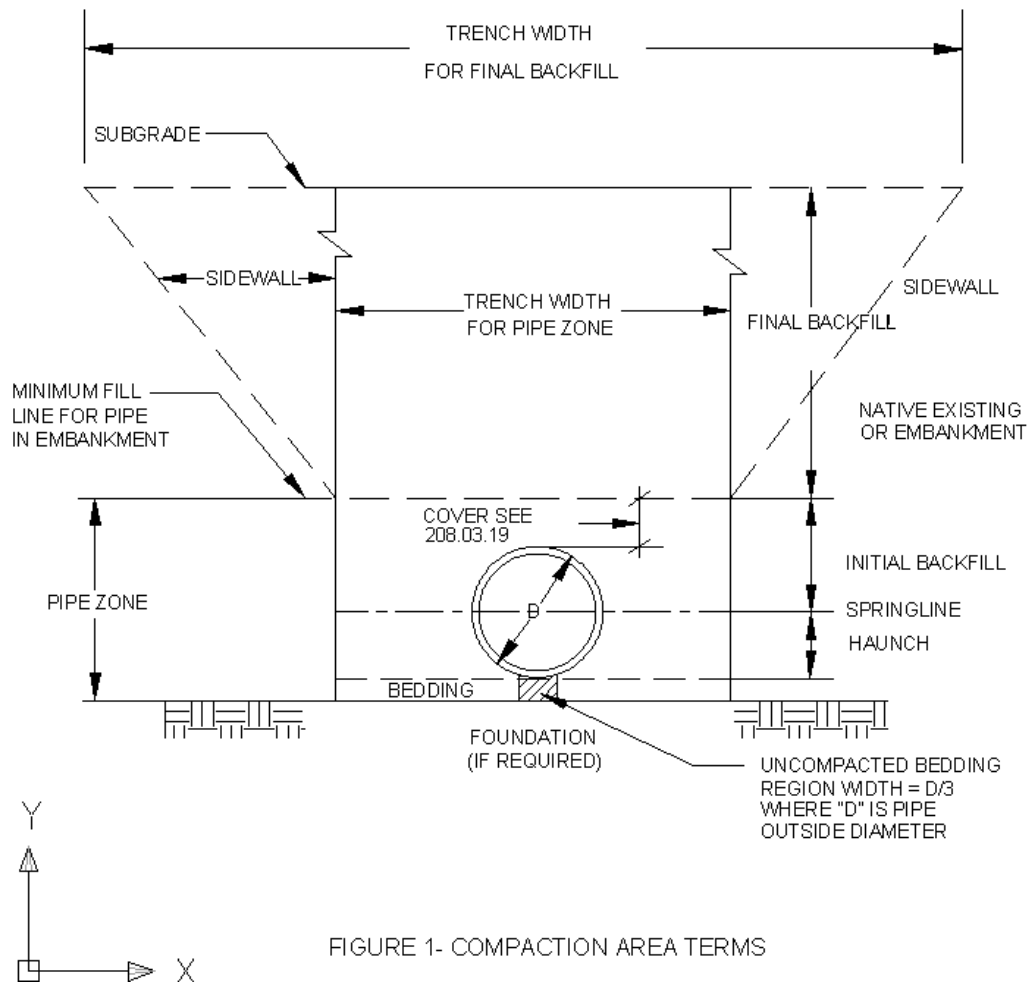


FIGURE 1- COMPACTION AREA TERMS

02MATERIALS

208.02.01 GENERAL

- A. The material placement in the pipe zone area shall first comply with Table 1, when applicable.

Table 1 - Pipe Zone Maximum Particle Size for Backfill

Nominal Pipe Size (inches)	Maximum Particle Size (inches)
2 to 4	1/2
6 to 8	3/4
10 to 16	1
18 and larger	1-1/2

- B. One of two methods of compaction of the trench pipe zone shall be used and shall be specified in the Construction Documents and approved by the Engineer prior to construction:

1. **Method A:** The use of CLSM as defined in this section.

2. **Method B:** The use of aggregate materials as described in this section as associated with either Rigid or Flexible designed pipe shall be as specified in this subsection below.
- C. Prior to construction, the materials and method type shall be submitted and approved by the Engineer.

208.02.02 SELECTED BACKFILL

- A. This material shall be similar to that removed from the trench excavation or may be imported material as specified in **Subsection [207.02.01](#), "Selected Backfill,"** or as otherwise shown on the Drawings.

208.02.03 GRANULAR BACKFILL

- A. Granular backfill shall be as specified in **Subsection [207.02.02](#), "Granular Backfill."**

208.02.04 SAND BACKFILL (DRY UTILITIES ONLY)

- A. Sand backfill shall consist of natural sand or a mixture of sand with gravel or stone. In addition thereto, the material shall conform to the following gradation requirements:

Table 2 - Sand Backfill Gradation

Sieve Sizes	Percentage of Weight Passing
3/8 inch	100
No. 4	80-100
No. 200	5-20

- B. The plasticity index of the material shall be as specified in **Subsection [704.03.01](#), "Plastic Limits."** The soluble sulfate content shall not exceed 0.3 percent by dry weight of soil.

208.02.05 TYPE II AGGREGATE BASE BACKFILL

- A. Type II aggregate base backfill shall be as specified in **Subsection [704.03.04](#), "Type II Aggregate Base."** The total available water soluble sulfate content shall not exceed 0.3 percent by dry weight of soil.

208.02.06 DRAIN BACKFILL

- A. Drain backfill shall be as specified in **Subsection [704.03.02](#), "Drain Backfill."** The type shall be as shown on the plans or approved by the Engineer.

208.02.07 CONTROLLED LOW STRENGTH MATERIAL (CLSM)

- A. Backfill shall be as specified in **Subsection [704.03.07](#), "Controlled Low Strength Material."**

208.02.08 CRUSHED ROCK

- A. The materials properties shall conform to **Subsection [704.03.06](#), "Crushed Rock."**

208.02.09 TYPE III AGGREGATE

- A. Aggregate properties and gradation shall conform to Type III as specified in **Subsection 704.03.05, "Type III Aggregate,"** or as approved by the Engineer.

03CONSTRUCTION**208.03.01 TRENCH EXCAVATION, GENERAL**

- A. Excavation including the manner of supporting excavation and provisions for access to trenches, shall comply with the current regulations as determined by NOSHA. Excavation shall include, without classifications, the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the work. The removal of said materials shall conform to the lines and grade shown. Excavation for pipe, wire, or conduits shall be by open trench unless otherwise specified or shown on the plans. However, should the Contractor elect to tunnel or jack any portion not so specified, he shall first submit a design by a Nevada Professional Engineer to and obtain an approval from the Engineer. The Contractor shall furnish, place, and maintain all supports and shoring that may be required for the sides of the excavation, and all pumping, ditching, or other approved measures for the removal or exclusion of water, including storm water and wastewater reaching the site of the work from any source so as to prevent damage to the work or adjoining property. The Contractor shall be responsible for any damage to persons or property due to interruption or diversion of storm or wastewater because of his operations. If due to delays in delivery of materials or for other reasons, and the Contractor is not expected to fully complete the work within any excavated area in a reasonable length of time as determined by the Engineer, the Engineer may require the Contractor to backfill the excavation and re-excavate when the work can be completed expeditiously, with no additional payment therefor.
- B. Except as otherwise shown or provided herein, excavation shall be open cut trenches with vertical sides up to the top of the pipe zone.

208.03.02 MINIMUM TRENCH WIDTH

- A. Excavation of pipe trench for flexible and rigid pipe is as required in Table 3 and this width is only applicable for trenches that have trench sidewall of native material"" which meets the classification class A1 or A3 installation as defined in AASHTO M145 table. In all cases, the trench width shall be wide enough to allow for the compaction equipment.

Table 3 - Minimum Trench Widths

Flexible Pipe	Minimum shall be not less than 1.5 times the pipe outside diameter plus 12 inches
Rigid Pipe	Minimum shall be not less than the outside diameter plus the outside diameter times 0.33

- B. For pipe backfill using CLSM, the minimum trench width may be reduced to the pipe diameter plus 12 inches and enough room needed to allow for the proper placement of the CLSM using tools to "spade" the material under the pipe haunches. This condition applies only for trench sidewalls meeting the minimum AASHTO material class A1 or A3.
- C. If the sidewall trench soil is classified other than AASHTO Class A1 or A3, a recommendation by a Nevada Professional Engineer shall be submitted and approved by the Engineer prior to construction. However, minimum trench width shall not be less than the minimum stated in this section.

208.03.03 MAXIMUM TRENCH WIDTH

- A. The maximum width of the trench shall be determined by the Contractor based on the method and means for the installation. However, trench width shall not exceed the width of a ride-along compactor plus 2 feet when working along side the pipe or culvert. If for any reason this maximum trench width is exceeded, a higher strength of pipe may be required as determined by the Engineer with no additional cost to the Contracting Agency.
- B. Except when otherwise specified or ordered by the Engineer, the bottom of the trench shall be excavated uniformly to the grade or depth indicated on the drawings. The maximum amount of open trench permitted in any one location shall be 500 feet, or the length necessary to accommodate the amount of pipe installed in a single day, whichever is greater, unless otherwise approved by the Engineer. Trench shall be considered open until backfilled to the top of subgrade. Trenches crossing streets shall be completely backfilled immediately after pipe, wire, or conduit installation.
- C. Substantial bridging, properly anchored, capable of carrying the design loading, in addition to adequate trench bracing, shall be used to bridge across trenches at street crossings where trench backfill and temporary patches have not been completed during regular working hours. Safe and convenient passage for pedestrians and access to all properties shall be provided.

208.03.04 TRENCH OVER-EXCAVATION

- A. Wherever the excavation is made below the grade shown on the drawings, or below the grade ordered by the Engineer, it shall be refilled to the required grade with suitable backfill and bedding material ""at no additional cost to the Contracting Agency.
- B. Trench over-excavation below the specified level of bedding material, and additional backfill material, ordered by the Engineer where unsuitable materials are encountered, shall be paid by the appropriate contract item.
- C. Trench over-excavation and backfill to control groundwater shall be at the option and expense of the Contractor; however, the backfill material shall comply with this specification and the approved design of the pipe.

208.03.05 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIALS

- A. Excess material and excavated material unsuitable for backfill shall be removed from the site of the work by the end of each working day unless otherwise approved by the Engineer and disposed of by the Contractor as specified in ***Subsection [107.14](#), "Disposal of Material Outside Project Right-of-Way."***

208.03.06 CHANGES IN ALIGNMENT OR GRADE

- A. In the event that changes in elevation of the trench of less than 6 inches are ordered by the Engineer, no changes in the contract amount will be allowed. When such changes in elevation are more than 6 inches or changes in alignment are made that change the character of the work required, the work shall be performed as specified in ***Subsection [104.02](#), "Increased or Decreased Quantities and Change in Character of Work."***

208.03.07 PORTABLE TRENCH SHIELD

- A. Portable trench shields or boxes that provide a moveable safe working area for installing pipe may be used for the installation of pipe. After placing the pipe in the trench, backfill

material shall be placed in lifts and the shield shall be lifted to allow for the backfill material to be placed for each lift, trench wall to trench wall.

208.03.08 MINIMUM PIPE SPACING

- A. If the pipe space between parallel pipes in a single trench is not conducive to mechanical backfill, then CLSM shall be used.

208.03.09 TRENCH BACKFILL

- A. The backfilling of the trench differs in each zone due to the complexity of providing a secure support for the pipe as well as ensuring that all voids are filled to prevent nuisance water flow under the pipe. The zones are foundation, bedding, haunch, initial, and final as illustrated in Figure 1.

208.03.10 USE OF CLSM

- A. CLSM Class I and Class II may be placed in all installations. However, for flexible pipe, in the pipe zone region, either full CLSM or full aggregate backfill is required. There can not be applied a mixing of CLSM and aggregate fill layers due to the different stresses that can occur on the pipe at the interface of both types of products.
- B. CLSM shall be placed directly into the space to be filled. The placement of CLSM shall include "spading" under the pipe haunches and into the corrugations or other difficult areas around a structure. Care shall be taken to prevent flotation or misalignment of the pipe by means of straps, soil anchors or other designed and approved means of restraint as per the manufacturer's recommendation. Material may be placed in stages equally on both sides of the pipe to prevent movement or flotation of pipe.
- C. If CLSM Class III - Bonded Aggregate Fill (BAF) is to be used, it shall be as specified in Subsection 704.03.07, "Controlled Low Strength Material (CLSM)." When used as backfill, CLSM Class III shall comply with Subsection 704.03.02, "Drain Backfill."

208.03.11 FOUNDATION

- A. Trench foundation shall be stable prior to placing bedding material. If the Engineer determines that unsuitable materials exist at the trench foundation, the Contractor shall remove and replace the material as directed by the Engineer and as specified in Subsection 208.03.04, "Trench Over-Excavation."

208.03.12 PIPE BEDDING

- A. **Dry Utilities:** Dry utilities shall be defined as facilities for fiber optics, electrical, telephone, television cable, traffic signals, and natural gas lines. Pipe bedding for dry utilities only may consist of sand in compliance with applicable utility agency's specifications. In all cases, when sand is used as a bedding material, the sand shall be moisture conditioned and mechanically compacted.
- B. **Wet Utilities:** Wet utilities shall be defined as facilities for sewer lines, water lines, and storm drains. Except as otherwise provided herein, or in the Special Provisions, or as otherwise shown on the plans, the trench shall be excavated to a depth of at least 4 inches to 6 inches below the bottom of the pipe barrel and to a depth that will be sufficient to provide at least 2 inches of clearance under the pipe bell (where applicable).

- C. Uniform and stable bedding shall be provided for the pipe and any protruding features of its joints and/or fittings with the exception that the middle of the bedding equal to 1/3 the pipe outside diameter shall be loosely placed (see Figure 1). The compaction shall be:
 - 1. Compaction density minimum = 90 percent of the maximum density as determined by test method AASHTO T180 with exception of the middle uncompacted area.
- D. The material for use as bedding shall be Type II/III Aggregate Base or CLSM complying with this section. Crushed Rock may be used to stabilize the trench foundation and shall be specifically approved by the governing agency.
- E. Bedding shall be backfilled to the required grade of the bottom of the pipe. When Crushed Rock is used for foundation stabilization, the Contractor shall follow the same procedures described below in **Subsection [208.03.16](#), "Drain Backfill."**
- F. All pipes shall be placed directly on the bedding material unless otherwise required or approved by the Engineer. If groundwater is present or anticipated to be present, the need for a filter material as specified in **Subsection [207.03.01](#), "General,"** shall be reviewed and approval may be required by the Engineer.

208.03.13 HAUNCH ZONE BACKFILL

- A. **Dry Utilities:** After pipe or conduit is laid, the haunch areas shall be backfilled with sand in compliance with applicable utility agency's specifications. In all cases, when sand is used as a backfill material, the sand shall be moisture conditioned and mechanically compacted.
- B. **Wet Utilities:** After the pipe or conduit is laid, the haunch areas shall be backfilled with Type II, Type III, Aggregate Base Backfill, or CLSM. Crushed Rock or drain backfill may be used for the haunch zone only if material use has been specifically approved by the governing agency. If crushed rock or drain backfill is used, comply with **Subsection [208.03.16](#), "Drain Backfill."**
- C. Compaction of the haunching material can best be accomplished by hand with tampers or suitable power compactors for maximum compacted lift thickness of 6 inches. The Contractor shall take care to not disturb the pipe from its line and grade and shall compact to:
 - 1. Compaction minimum = 90 percent of the maximum density as determined by test method AASHTO T180.
- D. While compacting the embedment near the pipe with impact-type tampers, caution shall be taken to not allow direct contact of the equipment with the pipe.

208.03.14 INITIAL ZONE BACKFILL

- A. **Dry Utilities:** Initial zone backfill for dry utilities may consist of sand in compliance with applicable utility agency's specifications. In all cases, when sand is used as a backfill material, the sand shall be moisture conditioned and mechanically compacted.
- B. **Wet Utilities:** After the pipe or conduit is laid, the initial backfill areas shall use Type II, Type III, Aggregate Base, or CLSM. Avoid usage of impact tampers directly above the pipe until the full loose layer backfill depth above the pipe is obtained. Crushed Rock or drain backfill may be used for the initial zone only if material use has been specifically approved by the governing agency. If crushed rock or drain backfill is used, comply with **Subsection [208.03.16](#), "Drain Backfill."** The depth of initial backfill above the pipe shall comply with Table 4:

Table 4 - Initial Zone Material Depths

Pipe or Conduit	Initial Zone
2-inch or less diameter	6 inches above the top of pipe
Greater than 2-inch diameter	12 inches above top of the pipe

208.03.15 FINAL ZONE BACKFILL

- A. The remaining backfill shall consist of one of the following types as determined by the Engineer.
- B. Granular, Selected, or CLSM Backfill. Backfill material from the initial backfill zone to a plane, which is below the bottom of the pavement section, shall be "Granular Backfill," "Selected Backfill," or CLSM.
 - 1. The material shall be compacted to:
 - a. Compaction minimum = 90 percent of the maximum density as determined by test method AASHTO T180.
 - b. If "Selected Backfill" is used in trenches 2 feet or less in width, no stones or lumps greater than 3 inches will be permitted.
 - 2. **CLSM:** When used, CLSM backfill shall be placed from the top of the initial backfill zone to the bottom of the bituminous pavement (top of aggregate base).
- C. CLSM Cap: Unless otherwise specified by the Contracting Agency, a CLSM Cap shall be required in the upper portion of the Final Zone for all non-residential roadways with a minimum thickness of 12 inches for all minor collectors and 24 inches for all major collectors and arterials.

208.03.16 DRAIN BACKFILL

- A. In the event that Drain Backfill is used to control groundwater, the Contractor shall, at no additional cost to the Contracting Agency, construct dams conforming to the requirements of **Section 501, "Portland Cement Concrete,"** Class II CLSM, or compacted Type II Aggregate Base. Construct the dams within the drain rock bedding material at each manhole or at intervals of 600 feet, whichever is less. Dams shall extend the width of the trench, a minimum of 18 inches in length, for the height of the drain backfill, and where Type II is used, the compaction shall be:
 - 1. Compaction minimum = 95 percent of the maximum density as determined by test method AASHTO T180.
- B. The Contractor shall install nonwoven geotextile filter fabric between the bedding and backfill material in such a manner to prevent migration of the backfill material into the bedding whenever Drain Rock or Crushed Rock is used as bedding.
- C. Geotextile filter fabric shall conform to the requirements specified in AASHTO M288, "Subsurface Drainage Geotextile."

208.03.17 COMPACTION

- A. Compaction shall be performed by mechanical means. Mechanically compacted backfill shall be placed in layers of thickness compatible with the characteristics of the backfill and the type of equipment being used and shall have a maximum lift thickness as indicated in Table 5 - Compaction Lift Thickness. The lifts shall be placed on both sides of the pipe at the same time to reduce pipe movement.

Table 5 - Compaction Lift Thickness

Location	Maximum Compacted Lift Thickness (inches)	Maximum Loose Lift Thickness (inches)
Bedding, Haunch, and Initial Zones	6	8
Final Zone Backfill	12	16

- B. Each layer shall be evenly spread, moistened, and tamped or rolled until the specified relative compaction has been attained.
- C. Compaction minimum = 90 percent of the maximum density as determined by test method AASHTO T180.

208.03.18 TRANSITION INSTALLATIONS

- A. When differential conditions of pipe support might occur, such as in transitions from manholes to trench, a transition support region shall be provided to ensure uniform pipe support and preclude the development of shear, or other concentrated loading on the pipe.

208.03.19 MINIMUM DEPTH OF COVER

- A. The minimum cover shall be as stated on the plans and/or contract Special Provisions. For flexible pipe, the minimum cover for compaction process using wheel or hydro hammer loads is 24 inches. Equipment used for the initial zone shall allow compaction to the lift requirements of this specification without damage to the pipe.

208.03.20 TESTING

- A. Where tests reveal non-compliance with the requirements of the Contract, the Contractor shall bear the costs of subsequent rework and retesting until the required specification compliance is obtained to the satisfaction of the Engineer.

208.03.21 CUTTING AND RESTORING STREET SURFACING

- A. Prior to beginning work within any public right-of-way, or cutting any street surfacing therein, an encroachment permit and barricade plan approval shall be obtained from the governmental entity or agency having jurisdiction over that right-of-way.
- B. Permit fees and construction restrictions shall be in accordance with the rules, regulations, and ordinances of the entity or agency having jurisdiction.
- C. While undergoing improvements, all streets upon or within which any work is being done shall be kept open to all traffic by the Contractor, as specified in **Subsection 104.04, "Maintenance of Traffic,"** unless otherwise approved by the Engineer, or as provided in the Special Provisions.
- D. Prior to beginning the work, barricading and traffic control devices conforming to the latest editions of the Traffic Control Plans for Highway Work Zones for the Clark County Area and the *Manual on Uniform Traffic Control Devices* shall be in place, and shall be in compliance with the governmental agency approved traffic control and barricade plan.
- E. Pavement in the area of the trench excavation may be wheel cut or spade cut.
- F. Temporary Steel Plate Bridging: When approved by the Engineer or Contracting Agency, the Contractor may use steel plates to bridge excavated trenches in areas where the

roadway surface is to be opened to traffic. Steel plates shall extend at least 12 inches beyond the edges of the trench. Trenches shall be adequately reinforced to support the bridging and traffic loads. Trench plate thickness shall be at least 3/4 inches for a 1 foot wide trench and shall increase 1/8 inch for every foot of trench width up to a thickness of 1-1/4 inch for a 5 foot wide trench. Steel plates for trench widths greater than 5 feet shall require a special structural design. Trench plates shall be coated with an Antiskid type surface meeting current Caltrans standards of a nominal Coefficient of friction of 0.35 in accordance with California test method 342 (Appendix H). Trench plates shall not be overlapped or stacked on top of another plate. At no time shall the length of any configuration of steel plates exceed three hundred feet or be left in place for longer than 14 days without prior written approval from the Engineer. The Contractor shall ensure that anchoring, strength and side supports are adequate to prevent collapse or movement of the plates. The placement and installation method for temporary steel plate bridging shall be as follows:

1. **Method 1: Roadways with posted speeds of 45 mph and greater, or when required by the Engineer** – The pavement shall be cold-planed to a depth equal to the thickness of the plate and to a width and length equal to the dimensions of the plate(s). Any voids shall be filled with cold mix and compacted to ensure that the roadway has a smooth drivable surface and the plate is flush with the top of the roadway surface (recessed into the asphalt.) The Contractor shall ensure that the approach and ending plates are securely attached to the roadway by a minimum of 2 dowels pre-drilled into the corners of the plate and drilled 2 inches into the pavement, subsequent plates shall be butted to each other. Steel Plate Ahead (W8-24) signs shall be used and shall be placed in accordance with the MUTCD and all municipal codes.
 2. **Method 2: Roadways with posted speeds less than 45 mph** – Approach and ending plates shall be attached to the roadway by a minimum of 2 dowels pre-drilled into the corners of the plate and drilled 2 inches into the pavement. Subsequent plates shall be butted to each other. Fine graded asphalt concrete shall be compacted to form ramps with a maximum slope of 8.5% and a minimum 18 inch taper to cover all edges of the steel plates. Steel Plate Ahead (W8-24) signs shall be used and shall be placed in accordance with the MUTCD and all municipal codes. When steel plates are removed, the dowel holes in the pavement shall be backfilled with either graded fines of asphalt concrete mix, concrete slurry, or equivalent slurry approved by the Engineer.
- G. Whenever permanent pavement patches are not constructed immediately following trench backfilling operations, temporary pavement patches consisting of a minimum of 2 inches of hot or cold plantmix or plates shall be utilized to provide the required number of paved travel lanes. Bump Ahead (W8-1) signs shall be used and shall be placed in accordance with the MUTCD and all municipal codes. Temporary pavement patches may be left in place for a maximum of 30 working days following completion of backfilling operations unless otherwise approved by the Engineer.
- H. The following surface tolerance for temporary patches shall be observed. When a 12-foot straight edge is laid across the temporary patch parallel to the centerline of the street and in a direction transverse to the centerline, a rut, hump, or depression of more than 1/2 inch shall not be evident. Deteriorated temporary patches exhibiting ruts, humps, or depressions shall be repaired or replaced immediately upon notification of the Engineer. If the existing street exceeds the above tolerances, then the temporary patch shall be equal to or better than the condition of the surrounding pavements.

- I. Unless otherwise specified and approved, prior to placing the permanent patch, the existing pavement shall be saw cut to a neat line and to a minimum width as shown on the Standard Drawings for Pavement Restoration.
- J. Existing aggregate base, shall be scarified and recompact to meet the requirements of **Section 302, "Aggregate Base Courses."** Compaction by rolling with vehicle tires will not be permitted. Aggregate base courses that were constructed with geosynthetics shall be repaired in conformance with the manufacturer's recommendations.
- K. Existing asphalt concrete shall be replaced with the same depth on major streets (greater than 60 feet of planned right-of-way) except that the minimum depth shall be 4) inches and shall be placed in multiple lifts of equal thickness. Existing asphalt concrete shall be replaced with the same depth in local streets (60 feet or less of planned right-of-way) except that the minimum depth shall be 3 inches; for existing depth of 4 inches or more, pavement shall be replaced in multiple lifts of equal thickness within the parameters established in **Section 401, "Plantmix Bituminous Pavements - General."** The pavement material shall be similar to the original. If not known, request from the Engineer the current mix type used on Contracting Agency Capital Improvement Projects (CIP).
- L. Completion of the permanent patch in areas where an open graded surface course exists, which is less than 10 years in age, shall include placement of a surface course to match the existing surface texture and material mix design, including original bituminous cement type.
- M. In areas where lime treated sub-base, cement modified sub-base, soil cement, or similar materials have been used, the Contractor may substitute a lean concrete mix or asphalt concrete equivalent, subject to approval of the Engineer.
- N. Upon completion of the permanent patch, including the surface treatment, the surface shall be thoroughly compacted, smooth, and free from ruts, humps, depressions, or irregularities. The Contractor shall inspect with a straightedge 12 feet long that is laid across the permanent patch parallel to the centerline of the street and in a direction transverse to the centerline. The surface shall not vary more than 1/4 inch from the lower edge of the straightedge. Patches exhibiting deviations greater than 1/4) inch shall be replaced or use mechanical grinding prior to acceptance of the patch. If the existing street exceeds the above tolerances, then the patch shall be equal to or better than the condition of the surrounding pavement. The Contractor shall submit a report of the tolerance testing to the Engineer for approval prior to the acceptance of the patch.
- O. Any concrete improvements disturbed or damaged during construction shall be replaced prior to placement of the permanent pavement patch.
- P. All traffic control devices removed or disturbed during construction shall be replaced upon completion of the permanent patch including but not limited to delineation, paint, thermoplastic pavement markings, and traffic signal detector loops. Temporary lane lines and other markings used during construction shall be permanently removed, to the satisfaction of the Engineer, prior to placing the new traffic stripes or markings.

04METHOD OF MEASUREMENT

208.04.01 MEASUREMENT

- A. Unless otherwise provided in the Special Provisions, trench excavation and backfill will not be measured for payment.

- B. The quantity of Permanent Patch to be measured for payment will be the number of square yards complete, in place, and conforming to all requirements herein.

05BASIS OF PAYMENT

208.05.01 PAYMENT

- A. Unless otherwise provided in the Special Provisions, no payment will be made for trench excavation or backfill as such; the cost thereof under normal circumstances being considered as included in the price bid for the construction or installation of the items to which such excavation or backfill is incidental or appurtenant.
- B. No payment will be made for temporary cold plantmix patching as such; the cost thereof is considered as included in the price bid for the construction or installation of the items to which such patching is incidental or appurtenant.
- C. The contract unit price paid for Permanent Patch as measured in ***Subsection 208.04.01, "Measurement,"*** shall be full compensation for saw cutting, removal of asphalt, Type II aggregate base, prime coat, tack coat, and seal coat if required, asphaltic pavement (excluding open-grade or gap-grade UTACS), pavement markings, compaction, and for all labor, tools, equipment and incidentals necessary to complete the work as specified herein, as shown on the plans, and as directed by the Engineer. Compensation for trenching, backfilling, and compaction of pipe zone and other items of work, which are considered as part of underground piping or conduit work, shall be included with the contract bid item for such piping or conduit work.
- D. Payment for such excavation or backfill will be made only when the Special Provisions provide.
- E. All payments will be made in accordance with ***Subsection 109.02, "Scope of Payment."***
- F. Payment will be made under:

PAY ITEM

PAY UNIT

Permanent Patch Square Yard

SECTION 401

PLANTMIX BITUMINOUS PAVEMENTS – GENERAL

01DESCRIPTION

401.01.01 GENERAL

- A. These specifications include general requirements that are applicable to all types of bituminous pavements of the plantmix type irrespective of gradation of aggregate, kind, and amount of bituminous material, or pavement use. Deviations from these general requirements will be indicated in the specific requirements for each type.
- B. This work shall consist of one or more courses of bituminous mixture constructed on the prepared foundation in accordance with these specifications and the specific requirements of the type under contract, and in conformity with the lines, grades, thicknesses, and typical cross sections shown on the plans or established by the Engineer.
- ~~B.C.~~ The testing and inspection of the asphalt concrete shall comply with this specification. In Clark County unincorporated areas and if required by other Contracting Agencies, all field and laboratory sampling and testing for project control shall be performed by NAQTC certified technicians in an AASHTO Materials Reference Laboratory (AMRL) or Construction Materials Engineering Council (CMEC) R-18 AASHTO accredited laboratory. The accreditation shall extend to the test method used on the particular project. The accreditation shall include ASTM D3666.

401.01.02 PAVEMENT STRUCTURAL DESIGN

- A. All public pavement sections shall be designed in accordance with the 1993 AASHTO Guide for Design of Pavement Structures. The following parameters, based upon the AASHTO Guide and the 1996 Nevada Department of Transportation Pavement Structural Design and Policy Manual, shall be used in the design calculations. Parameters which are specific to a road classification are identified by the right-of-way dimension. The design shall be stamped and signed by a professional engineer registered in the state of Nevada.
 - 1. The reliability factor will be a minimum of 80 percent with a standard normal deviate (ZR) of -0.841 for 51-foot, 60-foot, and 80-foot rights-of-way, and a minimum 90 percent with a standard normal deviate (ZR) of -1.282 for 100-foot rights-of-way.
 - 2. The standard deviation will be 0.45 for all classifications.
 - 3. The initial service index will be 4.2 and the final service index 2.5 for all classifications.
 - 4. Drainage coefficients shall not exceed 1.0.
 - 5. The structural coefficient for asphalt will be 0.35.
 - 6. For materials meeting **Subsection 704.03.04, "Type II Aggregate Base,"** the elastic modulus shall be 25,000 psi and the structural coefficient shall be 0.12.
 - 7. For materials meeting **Subsection 704.03.03, "Type I Aggregate Base,"** the elastic modulus shall be 15,000 psi and the structural coefficient shall be 0.11.
 - 8. Prior to design, soil testing will be performed in accordance with ASTM D2844 or AASHTO T190 to determine a representative Resistance (R) value for the prepared subgrade. The subgrade shall be prepared in accordance with the Geotechnical Soils Investigation Report, and soil sampling performed subsequent to rough

grading to confirm the original results. An average of the R-values may be used if the soil classification results are consistent, or if the values do not differ by more than 10. The minimum testing requirements are 1 right-of-way R-value test and post grading soil classifications every 1,000 linear feet of roadway, with a minimum of 2 classifications per project.

9. The subgrade R-value (psi) shall be converted to a Resilient Modulus (MR, psi) using the following correlation: $MR=145*(10^{((0.0147*R)+1.23)})$.
 10. The minimum AC sections are 2.0 inches for a residential street, 3.0 inches for a minor collector, 4.0 inches for a major collector, and 4.0 inches for an arterial street.
 11. All designs require a minimum of 4 inches Type II aggregate base material.
 12. The subgrade shall be scarified and recompacted to a minimum of 95 percent, to minimum depth of 8 inches.
 13. Expansive soils may require additional design compensation. If native soils classify as either an AASHTO A-6 or A-7 (more than 36 percent passing the #200 sieve and a PI equal to or greater than 11), the design may include stabilization, over-excavation, or utilization of a geomembrane, as recommended by the geotechnical engineer.
 14. Hydro-collapsible soils, or the presence of soluble materials, may require additional design compensation, as recommended by the geotechnical engineer.
- B. The minimum design equivalent axial loads (EAL) based on a 20-year design are 7.2E+3 for a residential street, 3.3E+4 for a minor collector, 3.7E+5 for a major collector, and 1.0E+6 for an arterial street. Locations with heavier than normal traffic shall be designed accordingly. A traffic study may be required for roads with a projected TI greater than 9.5. If required by the Contracting Agency, actual vehicle count data and assigned axle factors shall be used in the design of the pavement section. Definition of the roadway classifications, for design purposes, are listed below:
1. Residential roadways are those that provide access for residential areas only: Most 51-foot right-of-way roads are residential. The normal design TI is 5.0. A Residential road is considered to have heavy traffic, and a TI of 5.5, if minor amounts of thru-traffic use the road or bus traffic is encountered due to an adjacent school. Category II mix designs shall be used on residential streets.
 2. Minor Collector roadways are those that collect residential traffic or service limited commercial facilities: Most 60-foot and some 51-foot right-of-way roads fit this classification. The normal design TI is 6.0. A Minor Collector is assumed to have heavy traffic and a TI of 6.5 if there is substantial commercial truck traffic or bus traffic due to an adjacent school.
 3. Major Collector roadways are those that serve as destination roadways or service normal commercial or light industrial facilities: Most 80-foot, and some 60-foot, right-of-way roads fit this classification. The normal design TI is 8.0. A Major Collector is assumed to have heavy traffic, and a TI of 8.5, if there is substantial commercial or industrial truck traffic.
 4. Arterial roadways are those that provide primary traffic routes or service heavy industrial facilities: All 100-foot, and some 80-foot and 60-foot, right-of-way roads fit this classification. The normal design TI is 9.5. An arterial may have light traffic, if there is a disruption or decrease in the road capacity, in which case the design TI is 9.0. An Arterial is assumed to have heavy traffic if it is at full capacity with substantial truck traffic, or if there is heavy industrial traffic. A traffic study is recommended in those situations.

02MATERIALS

401.02.01 COMPOSITION OF MIXTURES

- A. The bituminous plantmix shall be composed of a mixture of aggregate, mineral filler if required, and bituminous material. The several aggregate fractions shall be sized, uniformly graded, and combined in such proportions that the resulting mixture meets the grading requirements of the job-mix formula.
- B. Before starting work, the Contractor shall submit a proposed job-mix formula in writing, for use by the Engineer in setting the job-mix formula to be used.
1. The proposed job-mix formula shall be determined by a testing laboratory under the direction and control of a registered professional engineer, based on tests performed in accordance with the "Marshall Method of Mix Design" as described in the Asphalt Institute Manual Series No. 2 (MS-2), latest edition.
 2. The number of compaction blows to be applied to the specimens will be based on the appropriate traffic category.
 3. Traffic Category I will use a 75-blow design and will apply to all arterial streets and wherever "heavy" traffic is expected.
 4. Traffic Category II will use a 50-blow design and will apply to collector and local streets.
 5. Unless otherwise specified, voids determinations and effective asphalt contents will be determined and reported in accordance with procedures described herein.
- C. The job-mix formula shall be selected in accordance with the following procedures:
1. Determine asphalt content required for 4 percent air voids, and
 2. Determine the average asphalt content for:
 - a. Maximum density.
 - b. Maximum stability.
 - c. 4 percent air voids.
 3. The lower of the asphalt contents obtained for a. or b. above will be used as the design asphalt content for the job-mix formula.
- D. The job-mix formula asphalt content shall satisfy all Marshall design criteria as shown in the following table:

MARSHALL DESIGN CRITERIA

TRAFFIC CATEGORY*	I TRAFFIC INDEX (TI) ≥ 7.0		II TRAFFIC INDEX (TI) < 7.0	
	75		50	
Compaction Blows Each End of Specimen	75		50	
Test Property	Min.	Max.	Min.	Max.
Stability, Lb.	1800	--	1500	--
Flow, 0.01 In.	8	14	8	16
Percent Total Air Voids	3	5	3	5

MARSHALL DESIGN CRITERIA

TRAFFIC CATEGORY*	I TRAFFIC INDEX (TI) ≥ 7.0		II TRAFFIC INDEX (TI) < 7.0	
Compaction Blows Each End of Specimen	75		50	
Test Property	Min.	Max.	Min.	Max.
Percent Voids Filled With Asphalt	65	75	65	78
Minimum Voids In Mineral Aggregate - Percent	See Table In Asphalt Institute MS-2 Manual			
* Traffic Category I - Applies to arterials and major collectors. See roadway classification in Subsection 401.01.02, “Pavement Structural Design.” Traffic Category II - Applies to minor collectors and residential streets. See roadway classification in Subsection 401.01.02, “Pavement Structural Design.”				

- E. In addition to the Marshall Design Criteria set forth herein, the job-mix formula shall also meet the following tensile strength requirements for all traffic categories:

TEST PROPERTY	TEST METHOD	REQUIREMENTS
Indirect Tensile Strength (Unconditioned)	AASHTO T283	65 psi minimum (50 psi minimum with AC-10 asphalt)
Indirect Tensile Strength (Retained Strength)	AASHTO T283	70 percent minimum

- F. Should the job-mix formula fail to meet the tensile strength requirements, the Contractor shall add hydrated lime (hereinafter referred to as mineral filler) to the plantmix bituminous aggregates as specified in **Subsection 401.03.08, "Preparation of Aggregates."** If the addition of mineral filler fails to achieve the minimum tensile strengths, the Contractor will be required to change sources of material, and submit a new job-mix formula that will satisfy all design criteria.
- G. The test report shall show the curves and data tabulations used to determine the following characteristics:
1. Unit weight per cubic foot.
 2. Percentage of air voids.
 3. Percent voids filled with asphalt.
 4. Marshall stability.
 5. Percent voids in mineral aggregate (VMA).
 6. Marshall flow.
 7. Indirect tensile strength (Unconditioned and Retained strength).
- H. Data tabulations shall include indications of the water absorption, aggregate bulk specific gravities for both coarse (retained on No. 8 sieve) and fine (passing No. 8 sieve) aggregate, theoretical specific gravity of bituminous mixture, absorbed asphalt, and effective asphalt content as determined in accordance with referenced Asphalt Institute procedures. ASTM D2041 will be used for determination of theoretical maximum specific gravity of bituminous paving mixtures.
- I. The test report shall give the recommended asphalt content and the values for:
1. Unit weight per cubic foot (bulk density).

2. Stability.
 3. Flow.
 4. Air voids.
 5. Voids filled with asphalt.
 6. Voids in mineral aggregate (VMA).
 7. Indirect tensile strength (Unconditioned and Retained strength).
- J. The formula submitted shall propose definite single values for:
1. The percentage of aggregate passing each specified sieve.
 2. The percentage of bitumen to be added (to 0.1 percent) based on weight of total mix.
 3. The percentage of mineral filler to be added to the aggregate.
 4. The temperature of the mixture leaving the mixer.
 5. The temperature of the mixture in the hopper of the paving machine.
- K. The job-mix formula aggregate with the allowable tolerances herein shall conform to **Section 705, "Aggregates for Bituminous Courses,"** for plantmix bituminous base aggregates, plantmix bituminous surface aggregate, or plantmix bituminous open-graded aggregate, as applicable.
- L. The Engineer will determine a job-mix formula with single values for **Subsection 401.02.01.J, "Composition of Mixtures,"** paragraphs 1 through 5 above, and so notify the Contractor in writing. This job-mix formula shall not be modified except with the written approval of the Engineer. The mix furnished shall conform to this job-mix formula, within the following range of tolerances:
1. Aggregate passing the No. 4 and larger sieves: ± 7 percent
 2. Aggregate passing the No. 8 to No. 100 sieves: ± 4 percent
 3. Aggregate passing the No. 200 sieve: ± 2 percent, but not to exceed upper limit of specification. Mineral filler is not considered as part of the aggregate.
 4. Bitumen content: ± 0.3 percent
 5. Temperature leaving the mixer: ± 20 degrees F
 6. Temperature in hopper of paving machine: ± 20 degrees F
- M. Should there be a change in sources of materials, a new job-mix formula shall be established before the new material is used. Check tests of properties of the plantmix bituminous materials shall be made on the first day of production and as requested by the Engineer during period of construction to confirm that all properties are in compliance with Marshall Design Criteria and tensile strength requirements. Adjustments in gradation, mineral filler content, and asphalt content shall be made as necessary to meet design criteria.
- N. The temperature of the bituminous material just prior to mixing and of the completed mixture in the hauling vehicle just prior to leaving the plant shall conform to the following table:

PLANTMIX BITUMINOUS MIXTURE WITH ASPHALT CEMENT

Grade of Asphalt Cement	Bituminous Material		Plantmix Bituminous Base of Surface Mixtures		Plantmix Bituminous Open-Graded Mixtures	
	Min.	Max.	Min.	Max.	Min.	Max.
PG76-22CC, PG64-34CC	275°F	350°F	275°F	350°F	--	--
AC-40	275°F	350°F	255°F	350°F	245°F	275°F
AC-20, AC-30	265°F	330°F	245°F	325°F	245°F	275°F
AC-10	255°F	325°F	235°F	325°F	--	--
AC-20P	280°F	350°F	300°F	350°F	300°F	350°F

401.02.02 AGGREGATES

- A. Aggregates shall comply with **Section 705, "Aggregates for Bituminous Courses."**

401.02.03 COMMERCIAL MINERAL FILLER

- A. Commercial mineral filler shall comply with **Subsection 705.03.04, "Commercial Mineral Filler."**

401.02.04 BITUMINOUS MATERIALS

- A. The bituminous material shall comply with **Section 703, "Bituminous Materials."** Bituminous material may be conditionally accepted at the source.
- B. Unless otherwise specified in the Special Provisions for Category I pavements, the grade of bituminous material for dense-graded mixes shall be AC-30 asphalt cement, except in the City of Las Vegas and the Clark County unincorporated areas, where PG76-22CC and PG64-34CC materials shall be used. An AC-30 or AC-20P asphalt cement shall be used for open-graded mixes as specified in **Subsection 403.02.02, "Composition of Mixture."** The grade may be changed one step by the Engineer.
- C. Unless otherwise specified in the Special Provisions, for Category II pavements the grade of bituminous material for dense-graded mixes shall be AC-30 or AC-20 asphalt cement, except in the Clark County unincorporated areas, where PG76-22CC and PG64-34CC materials shall be used. The grade may be changed one step by the Engineer.
- D. Certificates of Compliance for the asphalt, showing test values necessary for specification compliance, shall be made available upon request by the Engineer.

401.02.05 FIELD COMPACTION AND MIX DESIGN CORRELATION

- A. Type 2 coarse mix design annual submittals only.
- B. In an effort to establish the "point of refusal," if it has been determined that the in-place air voids are less than 6 percent or more than 8 percent, the mix design bitumen content shall be adjusted. This procedure will be required as a part of all new mix designs, and any field adjustment shall be noted.
- C. The field compaction shall be as required in **Section 401.03.11, "Rolling and Compaction."**
1. The in-place air voids, as based on the Maximum Theoretical Specific Gravity and 10 correlated nuclear tests or 5 cores, shall then be calculated.

2. If the mean percent air voids is outside the limits noted above, the bitumen content shall be mathematically increased or reduced and noted on the mix design submittal. If adjustment is made, then a new control strip is required.
 3. Once the control strip meets the above requirements, it becomes the control strip for subsequent mix placements.
- D. Subsequent compaction testing lots shall be tested in accordance with **Section [401.03.12](#), "Acceptance Sampling and Testing of Bituminous Mixture."** If the compaction cannot be maintained between the above limits, a new control strip shall be implemented to re-establish the mean density for testing.

03CONSTRUCTION

401.03.01 BITUMINOUS MIXING PLANT

- A. Sufficient storage space shall be provided for the aggregate, or for each size aggregate when required. The storage yard shall be maintained neat and orderly and the stockpile, or separate stockpiles when required, shall be readily accessible for sampling.
- B. Mixing plants shall be of sufficient capacity and coordinated to adequately handle the proposed bituminous construction.
- C. **Mixing Plants.** Plants used for the preparation of bituminous mixtures shall conform to the following requirements:
 1. Equipment for Preparation of Bituminous Material:
 - a. Tanks for the storage of bituminous material shall be equipped to heat and hold the material at the required temperatures.
 - b. The heating shall be accomplished by steam coils, electricity, or other approved means so that no flame shall be in contact with the tank or contents.
 - c. The circulating system for the bituminous material shall be designed to ensure proper and continuous circulation during the operating period.
 - d. Provisions shall be made for measuring and sampling storage tanks.
 2. Drier: The plant shall include a drier or driers which continuously agitate the aggregate during the heating and drying process.
 3. Thermometric Equipment:
 - a. An armored thermometer of adequate range in temperature reading shall be fixed in the bituminous feed line at a suitable location near the charging valve at the mixer unit.
 - b. The plant shall be equipped with either an approved dial-scale, mercury-actuated thermometer, an electric pyrometer, or other approved thermometric instrument so placed at the discharge chute of the drier as to register automatically or indicate the temperature of the heated aggregate.
 - c. The Engineer may require replacement of any thermometer by an approved temperature-recording apparatus for better regulation of the temperature of aggregates.
 4. Smoke and Dust Control: The Contractor will be required to install satisfactory precipitation devices, or use other methods which will meet local conditions, city and

county regulations as set forth by the Clark County Air Pollution Control Officer, and state laws pertinent to air pollution.

5. Truck Scales:
 - a. Except as allowed in **Subsection 401.04.01, "Measurement,"** bituminous mixture shall be weighed on approved scales furnished by the Contractor or on public scales at no cost to the Contracting Agency.
 - b. Such scales shall be platform scales and conform to the provisions of **Subsection 109.01, "Measurement of Quantities."**
 6. Safety Requirements:
 - a. Adequate and safe stairways to the mixer platform and sampling points shall be provided and guarded ladders to other plant units shall be placed at all points where accessibility to plant operations is required.
 - b. Accessibility to the top of truck bodies shall be provided by a platform or other suitable device to enable the Engineer to obtain sampling and mixture temperature data.
 - c. A hoist or pulley system shall be provided to raise scale calibration equipment, sampling equipment, and other similar equipment from the ground to the mixer platform and return.
 - d. All gates, pulleys, chains, sprockets, and other dangerous moving parts shall be thoroughly guarded and protected.
 - e. Ample and unobstructed passage shall be maintained at all times in and around the truck loading area.
 - f. This area shall be kept from drippings from the mixing platform.
- D. **Batching Plants.** Batch mixing plants shall conform to the following requirements:
1. Plant Scales:
 - a. Scales shall be accurate to 0.5 percent of the minimum load that may be required. Poises shall be designed to be locked in any position to prevent unauthorized change of position.
 - b. Scales shall be as described in **Subsection 109.01, "Measurement of Quantities."** In lieu of truck scales, the Contractor may provide an approved automatic printer system which will print the weights of the material delivered, provided the system is used in conjunction with an approved automatic batching control system. Such weights shall be evidenced by a weight ticket for each load.
 - c. The amount of filler material shall be determined by weighing on springless dial scales separate from the plant weigh hopper or by some method that uniformly feeds the mixer within 10 percent of the required amount.
 2. Feeder for Drier: The plant shall be provided with accurate mechanical means for uniformly feeding the aggregate into the drier so that uniform production and uniform temperature will be obtained.
 3. Screens: Plant screens capable of screening the aggregate to the specified sizes will be required.
 4. Bins:

- a. The plant shall include storage bins of sufficient capacity to supply the mixer when it is operating at full capacity.
 - b. Bins shall be arranged to ensure separate and adequate storage of appropriate fractions of the mineral aggregates.
 - c. Separate dry storage shall be provided for mineral filler when used and the plant shall be equipped to feed such material into the mixer.
 - d. Each bin shall be provided with overflow pipes, of such size and at such locations as to prevent backing up of material into other compartments or bins.
 - 1) Each compartment shall be provided with its individual outlet gate constructed so that when closed there shall be no leakage.
 - 2) The gates shall cut off quickly and completely.
 - 3) Bins shall be so constructed that samples representative of the entire material in the bin can be readily obtained.
5. Weigh Box or Hopper:
- a. All materials shall be proportioned by weight.
 - b. Aggregate scales shall be one of the following:
 - 1) Multiple beam scale.
 - 2) Springless dial type scale.
 - 3) Fully automatic solid-state digital strain gauge transducer measuring device.
 - c. Aggregate scales shall have a capacity exceeding 1-1/4 times the total amount of materials to be weighed in one operation. Each scale gradation shall be approximately 1/1000 of the total capacity of the scale.
 - d. All scales used for proportioning materials shall be accurate to within 1 percent.
 - 1) The scales shall be sealed and certified by the State Sealer of Weights and Measures.
 - 2) Certifications shall be dated within the past 12 months and shall be renewed whenever required by the Engineer.
 - 3) If the plant is moved, a new certificate will be required.
 - e. All scales shall be of such size and so arranged that they may be read easily from the operator's platform.
 - 1) The scales shall indicate the true net weight without the application of any factor.
 - 2) The dials of scales shall not be less than 12 inches in diameter.
 - 3) The figures on the scale dials shall be clearly legible.
 - f. Weighing equipment shall be so insulated against the vibration or movement of other operating equipment in the plant that the error in weighing with the entire plant running will not exceed 1-1/2 percent for any batch.

6. Bituminous Control Unit: Satisfactory means, either by weighing or metering, shall be provided to obtain the proper amount of bituminous material in the mix within the tolerance specified. Means shall be provided for checking the quantity or rate of flow of bituminous material into the mixer.
7. Bituminous Control:
 - a. The equipment used to measure the bituminous material shall be accurate to plus or minus 0.5 percent.
 - 1) The bituminous material bucket shall be a non-tilting type with a loose sheet metal cover.
 - 2) The length of the discharge opening or spray bar shall be not less than three-fourths the length of the mixer and it shall discharge directly into the mixer.
 - 3) The bituminous material bucket, its discharge valve or valves, and spray bar shall be adequately heated.
 - 4) Steam jackets, if used, shall be efficiently drained and all connections shall be so constructed that they will not interfere with the efficient operation of the bituminous scales.
 - 5) The capacity of the bituminous material bucket shall be at least 15 percent in excess of the weight of bituminous material required in any batch.
 - 6) The plant shall have an adequately heated quick-acting, non-drip, charging valve located directly over the bituminous material bucket.
 - b. Bituminous material shall be measured by means of springless dial scales or metering devices. Springless dial scales shall have a capacity of not more than 1,000 pounds in 2-pound gradations.
 - 1) The indicator dial shall have a capacity of at least 15 percent in excess of the quantity of bituminous material used in a batch.
 - 2) The controls shall be constructed so that they may be locked at any dial setting and will automatically reset to that reading after the addition of bituminous material to each batch.
 - 3) The dial shall be in full view of the mixer operator.
 - c. The flow of bituminous material shall be automatically controlled so that it will begin when the dry mixing period is over.
 - 1) All of the bituminous material required for one batch shall be discharged in not more than 15 seconds after the flow has started.
 - 2) The size and spacing of the spray bar openings shall provide a uniform application of bituminous material the full length of the mixer.
 - 3) The section of the bituminous line between the charging valve and the spray bar shall be provided with a valve and outlet for checking the accuracy of the meter when a metering device is substituted for a bituminous material bucket.
8. Mixer:

- a. The batch mixer shall be of a twin pugmill type, steam jacketed, or heated by other approved means and capable of producing uniform mixtures within the specified tolerances.
 - b. It shall be equipped with a sufficient number of paddles or blades set in proper order and operated at such speed as to produce a properly and uniformly mixed batch.
 - c. At the beginning of the mixing operation, the clearance between paddle tips and liner shall not exceed half the maximum aggregate diameter for the specified job mix.
 - d. The clearance of the paddles or blades from all fixed and moving parts shall not exceed 1 inch.
 - e. Badly worn or defective paddles or blades shall not be used in mixing operations.
9. Control of Mixing Time:
- a. The mixer shall be equipped with an accurate time lock to control the operations of a complete mixing cycle.
 - 1) It shall lock the weigh box gate after the charging of the mixer until the closing of the mixer gate at the completion of the cycle.
 - 2) It shall lock the mixer gates throughout the dry and wet mixing periods.
 - 3) The dry mixing period is defined as the interval of time between the opening of the weigh box gate and the start of introduction of bituminous material.
 - 4) The wet mixing period is the interval of time between the start of introduction of bituminous material and the opening of the mixer gate.
 - b. The mixer shall be equipped with a timing device which will indicate by a definite audible or visual signal the expiration of the mixing period.
 - 1) The device shall measure the time of mixing within an accuracy of 2 seconds.
 - 2) A suitable automatic device for counting the number of completely mixed batches shall be provided and maintained in proper working condition.
 - c. When the aggregate and the bituminous material have been combined, the entire mass shall be mixed in a approved mixer.
 - 1) The mixing shall continue until homogeneity and a uniform coating are achieved.
 - 2) The output rate shall not exceed the manufacturer's capacity rating.
- E. **Drier Drum Mixing Plants.** Drier drum mixing plants shall conform to the following requirements:
- 1. Aggregate Stockpiles: Comply with **Subsection [401.03.08](#), “Preparation of Aggregates”** paragraphs A through C.
 - 2. Aggregate Proportioning:

- a. The plant shall include a means for accurately proportioning each bin size of aggregate prior to the drying operation.
- b. The plant shall have a mechanical feeder mounted under each compartment bin.
 - 1) Each compartment bin shall have an accurately controlled individual gate for volumetrically measuring the material drawn from each compartment.
 - 2) The feeding orifice shall be rectangular with one dimension adjustable by positive means.
 - 3) Indicators shall be provided for each gate to show the respective gate opening in inches.
- c. A meter for determining the rate of each feeder, or a revolution counter, shall be provided. Commercial filler material introduced into the mixer shall be drawn from storage bins by a continuous mechanical feeder which will uniformly feed the mixer within 10 percent of the required amount.
- 3. Weight Calibration of Aggregate: The plant shall include a means for calibration for each aggregate feeder by weighing test samples.
- 4. Bituminous Metering Device: The bituminous material shall be introduced into the mixer through a gallonage meter by a positive displacement metering device, equipped with a ready means of varying the bituminous material delivery rate.
- 5. Synchronization of Aggregate Feed and Bituminous Material Feed:
 - a. Satisfactory means shall be provided to afford a positive interlocking control between the flow of aggregate from each feeder and the flow of bituminous material.
 - b. The interlocking control shall indicate a visible or audible signal when the level of material in any one feeder approaches the strike off capacity of the feed gate, or shut the plant down.
- 6. Mixer:
 - a. The plant shall include a mixing device which will obtain homogeneity and a uniform coating.
 - b. The mixing output shall not exceed the manufacturer's capacity rating.
 - c. The moisture content of the bituminous mixture shall not exceed 3 percent at the discharge end of the dryer.
- 7. Surge Bins: The plant will be equipped with an approved surge bin at the discharge. This surge bin will be in excess of 20 tons, and shall be equipped with an approved surge batcher or other approved method satisfactory to the Engineer that will prevent segregation of the bituminous mixture as it is being discharged into the hauling vehicle.

401.03.02 HAULING EQUIPMENT

- A. Trucks used for hauling bituminous mixtures shall have tight, clean, smooth beds which have been thinly coated with a minimum amount of paraffin oil, lime solution, or other approved material to prevent the mixture from adhering to the beds.

401.03.03 PAVERS

- A. Bituminous pavers shall be self-contained, self-propelled units provided with an activated screed or strike-off assembly, heated if necessary, and capable of spreading the finishing courses of bituminous plantmix material in lane widths applicable to the specified typical section and thicknesses shown on the plans.
- B. Pavers used for shoulders and similar construction shall be capable of spreading and finishing courses of bituminous plantmix material in widths shown on the plans.
- C. The asphalt paver shall operate independently of the vehicle being unloaded and shall be capable of propelling the vehicle being unloaded in a satisfactory manner.
 - 1. If necessary, the load of the haul vehicle shall be limited to that which will ensure satisfactory spreading.
 - 2. While being unloaded, the haul vehicle shall be in contact with the machine at all times, and the brakes on the haul vehicle shall not be depended upon to maintain contact between the vehicle and the machine.
- D. Pavers shall be equipped with a receiving hopper having sufficient capacity for a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed.
- E. The screed or strike-off assembly shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.
- F. Pavers shall be capable of placing the bituminous mixture to meet the surface tolerances specified under the respective sections of bituminous pavement.

401.03.04 ROLLERS

- A. Rollers shall be vibratory, steel-wheeled or pneumatic-tired type, in good condition.
 - 1. Rollers shall be capable of reversing without backlash and operating at slow speeds to avoid displacement of the bituminous mixture.
 - 2. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density without detrimentally affecting the completed material as determined by the Engineer.
 - 3. Comply with ***Subsection [401.03.11](#), "Rolling and Compaction."***
- B. Rollers for the test strip shall meet the following requirements:
 - 1. Breakdown rollers shall be either a 3-wheeled steel roller or a 2-axle tandem or a 3-axle tandem weighing not less than 10 tons.
 - 2. Except as hereinafter permitted, pneumatic-tired rollers shall comply with the following:
 - a. Rollers shall consist of not less than 9 wheels equipped with pneumatic tires of equal size and diameter.
 - b. Tires shall be mounted on 2 axles attached to a rigid frame, equipped with a loading platform or body suitable for ballast loading, so that the total weight of the roller can be varied to produce an operating weight per tire of between 1,000 and 2,000 pounds.
 - c. The tires shall have treads satisfactory to the Engineer.

- d. The tires on the rear axle shall be so spaced that the entire gap between adjacent tires on the front axle will be covered by 1 tread of the following tires.
 - e. The tires shall be uniformly inflated so that the air pressure in the several tires will not vary more than 5 pounds per square inch. Inflation pressure in pounds per square inch shall be the tire manufacturer's recommendation.
 - f. Minimum tire size shall be 7.50 x 15 inches, 4 ply.
3. The use of pneumatic-tired rollers with fewer wheels and a greater maximum operating weight per tire than that specified herein will be permitted subject to the following requirements:
- a. The minimum width between the outer edge of the outside tires on a given axle shall be 60 inches.
 - b. The weight of the roller and the tire pressure can be varied to produce a ground contact pressure between 50 and 70 psi.
4. The finish roller shall be a 2-axle tandem weighing not less than 8 tons.

401.03.05 WEATHER LIMITATIONS

- A. The bituminous mixture shall not be placed upon any wet surface or when the surface temperatures of the underlying course is less than specified in Table 1. The temperature requirements may be modified, but only when so directed by the Engineer.

TABLE 1 - BASE TEMPERATURE LIMITATIONS

Mat Thickness	Base Temperature (Minimum °F)
3 Inches or Greater	40
Greater than 1 Inch but Less than 3 Inches	45
1 Inch or Less	50

- B. The open-graded plantmix surface shall be placed only when the pavement surface temperature is above 60 degrees F.

401.03.06 PREPARATION OF EXISTING SURFACE

- A. When the surface of the existing pavement or old base is irregular, it shall be brought to a uniform grade and cross section as shown on the plans.
- B. The subgrade to receive asphalt concrete, or asphalt concrete base immediately prior to applying prime coat, shall conform to the compaction and elevation tolerance specified for the material involved and shall be free of loose or extraneous material.
- C. If the plantmix bituminous surface is being constructed directly upon an existing hard-surfaced pavement, a tack coat of grade CSS-1h or SS-1h emulsified asphalt, diluted 50/50 at an approximate rate of 0.05 to 0.10 gallons per square yard, shall be uniformly applied upon the existing pavement preceding the placement of the asphalt concrete.
- 1. The surface shall be free of water, foreign material, or dust when the tack coat is applied.

2. To minimize public inconvenience, no greater area shall be treated in any one day than is planned to be covered by plantmix during the same day, unless otherwise authorized by the Engineer.
- D. A similar tack coat shall be applied to the surface of any previous course placed longer than 24 hours, or if a satisfactory bond cannot be obtained between the surface and a succeeding course, as determined by the Engineer.
- E. The contact surfaces of all cold pavement joints, curbs, gutters, manholes, and similar structures shall be painted with grade CSS-1h or SS-1h emulsified asphalt immediately before the new asphalt concrete is placed. Comply with **Section 405, "Tack Coat."**
- F. When specified in the contract, longitudinal and transverse joints and cracks shall be sealed by the application of an approved joint sealing compound before spreading the mixture upon a Portland cement concrete surface. Excess bituminous material shall be removed from joints and cracks prior to spreading the mixture.

401.03.07 PREPARATION OF BITUMINOUS MATERIALS

- A. The bituminous material shall be heated to the specified temperature in a manner that will avoid local overheating and provide a continuous supply of the bituminous material to the mixer at a uniform temperature at all times.

401.03.08 PREPARATION OF AGGREGATES

- A. Aggregates proportioned prior to the heating and drying process shall be separated into at least two general sizes:
 1. That portion of the material having a minimum of 80 percent passing No. 4 sieve.
 2. That portion of the material having a minimum of 80 percent retained on a No. 4 sieve.
- B. The material shall be maintained within the limits above with a uniformity of plus or minus 5 percent. Each portion of the material shall be stored separately.
- C. When moving the aggregate from storage to compartment bins, any method may be used which will not cause segregation, degradation, or combinations of aggregate which fail to meet the specified gradation requirement. Plantmix operations shall not commence until sufficient aggregate material is stockpiled to ensure one day's run.
- D. Aggregate proportioned immediately after the heating and drying process shall be screened into a minimum of 2 fractions when minus 1/2-inch aggregate is used, and into a minimum of 3 fractions when larger sized aggregate is used. The screened material shall be conveyed to separate compartments ready for proportioning and mixing with bituminous material.
- E. If the Contractor elects to introduce baghouse fines into the mix, the material shall be drawn from a storage facility in which the material is kept in a uniform free flowing condition.
 1. The baghouse fines for delivery to the plant shall be from a vane type metering device which is interlocked (electrical driven feeders shall be activated from the same circuit) to the flow of each aggregate feeder.
 2. The drive shaft on the baghouse fines vane feeder shall be equipped with a revolution counter accurate to 1/10 of a revolution, and a means for varying the rate.
 3. In a continuous mix and/or dryer drum plant, the baghouse fines shall be added at the asphalt feed line to ensure a uniform mix.

4. In batch plants, the baghouse fines shall be added by the use of a separate bin.
 5. The baghouse fines shall be introduced at a point as approved by the Engineer at a percentage determined by the Engineer, not to exceed 2 percent by dry weight of the aggregate.
 6. Baghouse fines shall be considered as part of the aggregate, and not as a mineral filler.
- F. If mineral filler is required to meet the tensile strength requirements of the job-mix formula, it shall be added by one of the following methods:
1. Cold Feed Method:
 - a. Hydrated lime (hereinafter referred to as mineral filler) shall be added to all plantmix bituminous aggregates at the rate of not less than 1 percent nor more than 2-1/2 percent of the weight of the dry aggregate. The exact rate of application shall be as determined by the job mix formula.
 - b. Mineral filler shall be drawn from a storage facility in which the mineral filler is agitated by air or other means to keep it in a uniform free flowing condition.
 - 1) The mineral filler for delivery to the mixer shall be from a vane type metering device which is interlocked, (electrical driven feeders shall be actuated from the same circuit) to the flow of each aggregate feeder.
 - 2) The drive shaft on the mineral filler vane feeder shall be equipped with a revolution counter reading to 1/10 of a revolution, and a means for varying the rate.
 - c. In continuous mix and/or drum dryer plants, the mineral filler shall be added to the aggregate after the aggregate is proportioned.
 - d. In batch plants, the mineral filler shall be added to the aggregate prior to drying.
 - e. Regardless of which type of plant is used, the following methods shall be utilized:
 - 1) Prior to the introduction of the mineral filler, sufficient moisture shall be added using spray bars at the aggregate bins to bring the aggregate to a moisture content where enough free surface moisture is available to thoroughly wet the aggregate and wet the lime.
 - a) This content shall be a minimum of 4 percent.
 - b) The actual amount of moisture required will be determined by the Engineer.
 - c) After the addition of water and mineral filler, the aggregate shall be mixed using a horizontal twin-shaft pugmill.
 - d) The mixing paddles shall be adjustable for angular position on the shaft to permit altering of the mixing pattern or retarding the flow to ensure that the aggregate is thoroughly coated with mineral filler.
 - e) The volume of material in the pugmill shall not extend above the vertical position of the blade tips.

- f) The completed mixture shall be directly introduced into the hot plant.
 - g) Stockpiling of the completed mixture is strictly prohibited.
 - 2) The moisture control valve shall be interlocked with the hot plant control room so the moisture control valve is automatically turned off when the cold feed belts are shut off. The control valve shall also turn on automatically when the cold feed belts are activated.
- 2. Marination Method:
 - a. Hydrated lime (hereinafter referred to as mineral filler) shall be added to all fractions of the plantmix bituminous aggregates.
 - 1) The coarse aggregates shall be wet cured with mineral filler at a rate of 1 percent of the weight of dry aggregate.
 - 2) The fine aggregates shall be wet cured with mineral filler at a minimum rate of 2 percent of the weight of the dry aggregate.
 - b. The aggregates shall be marinated (wet cured) in the stockpiles for a minimum of 48 hours.
 - c. The wet cured aggregate in the stockpile shall be used within 45 calendar days. Material marinated in stockpile in excess of 45 calendar days shall not be used for the production of plantmix bituminous aggregates unless otherwise approved by the Engineer.
 - d. Prior to the introduction of the mineral filler, sufficient moisture shall be added using spray bars at the aggregate bins to bring the aggregates to a moisture content where enough free surface moisture is available to thoroughly wet the aggregate and activate the lime.
 - 1) This content is recommended to be a minimum of 3 percent for coarse aggregates and 6 percent for the fine aggregates.
 - 2) The actual amount of moisture required will be determined by the Engineer.
 - 3) After the addition of water and mineral filler, the aggregate shall be mixed using a horizontal twin-shaft pugmill.
 - 4) The mixing paddles shall be adjustable for angular position on the shaft to permit altering of the mixing pattern or retarding the flow to ensure that the aggregate is thoroughly coated with mineral filler.
 - 5) The volume of material in the pugmill shall not extend above the vertical position of the blade tips.
 - e. Mineral filler shall be drawn from a storage facility in which the mineral filler is agitated by air or other means to keep it in a uniform free flowing condition.
 - 1) The mineral filler for delivery to the mixer shall be from a vane type metering device which is interlocked (electrical driven feeders shall be actuated from the same circuit) to the flow of each aggregate feeder.
 - 2) The drive shaft on the mineral filler vane feeder shall be equipped with a revolution counter reading to 1/10 of a revolution, and a means for varying the rate.

3. Slurry Method:

- a. Hydrated lime or slaked quicklime (hereinafter referred to as mineral filler) shall be added to all plantmix bituminous aggregates in slurry form.
 - 1) Add at a rate of not less than 1 percent nor more than 2-1/2 percent of dry mineral filler based on the weight of the dry aggregate.
 - 2) The exact rate of application shall be as determined by the job-mix formula.
- b. A slurry containing 1 part mineral filler and 2 parts water by weight is recommended.
 - 1) The actual amount of water required in the production of the slurry will be determined by the Engineer after a visual inspection to ensure that the aggregate is thoroughly and uniformly coated with the mineral filler.
 - 2) The addition of moisture to the aggregate prior to mixing of the mineral filler and aggregate will not normally be required.
- c. The slurry shall be prepared in a central mixing tank provided with agitation for keeping the mineral filler in suspension until applied to the aggregate.
 - 1) The slurry mixing tanks shall be capable of producing sufficient slurry for the hot mix asphalt manufacturing facility production rate, and shall produce a uniform slurry consistency.
 - 2) The plant shall be equipped with suitable pumps and meters for introducing the required amount of slurry to the aggregate. A suitable device shall be provided to the Engineer for determining the weight of mineral filler per gallon of slurry.
- d. If quicklime is used as the mineral filler, it shall be converted to hydrated lime by using one or more slaking tanks. The slaking unit shall be capable of:
 - 1) Complete slaking or hydration of the quicklime.
 - 2) Providing agitation for mixing and keeping the mineral filler in suspension until use.
- e. After the addition of the mineral filler slurry, the aggregate shall be mixed using a horizontal twin-shaft pugmill.
 - 1) The mixing paddles shall be adjustable for angular position of the shaft to permit altering of the mixing pattern or retarding the flow to ensure that the aggregate is thoroughly coated with mineral filler.
 - 2) The volume of material in the pugmill shall not extend above the vertical position of the blade tips.
 - 3) The completed mixture shall be directly introduced into the hot plant.
 - 4) Stockpiling of the completed mixture is strictly prohibited.

401.03.09 MIXING

- A. The permissible moisture content of the bituminous mixture just behind the paver shall not exceed 1-1/2 percent as determined by test method ASTM D1461 or equivalent.

1. Should the aggregate contain excessive moisture when heated within the temperature limits, the Contractor will be required to take satisfactory corrective action before resuming plantmix operations.
 2. When an approved dryer drum mixing process is used, the moisture content of the bituminous mixture at discharge from the mixer shall not exceed 3 percent, and the resulting product at the discharge end of the drier shall be a homogenous mixture of uniformly distributed and properly coated aggregates of unchanging appearance.
- B. The drier aggregate shall be combined in the mixer in the amount of each fraction of aggregates required to meet the job-mix formula. The bituminous material shall be measured or gauged and introduced into the mixer in the amount specified by the job-mix formula.
- C. Commercial filler material, when required, shall be added to the mixer separately and shall be thoroughly dry. If the materials are mixed in a batching plant, the filler material shall be fed directly into the mixer as near the center as possible.
- D. The time of mixing a batch shall begin on the charging stroke of the weight hopper dumping mechanism and shall end when discharge is started.
1. Mixing shall continue until a homogenous mixture of uniformly distributed and properly coated aggregates of unchanging appearance is produced.
 2. In general, the time of mixing shall not be less than 30 seconds, except that the time may be reduced when, in the opinion of the Engineer, the sizes of aggregates are uniformly distributed and all particles are thoroughly and uniformly coated with asphalt binder.
 3. The output rate shall not exceed the manufacturer's capacity rating.
- E. Should the mixture, at the plant or in place, show an excess or deficiency of bitumen, show injury or damage due to burning or overheating, or show an improper combination of aggregates, due to the Contractor's failure to conform to the specified requirements, it shall be rejected and if still in the truck shall be disposed of as required. If an unsatisfactory mix, as referred to above, has been placed, it shall be disposed of and replaced as directed. No compensation will be allowed for rejected material.

401.03.10 SPREADING AND FINISHING

- A. The mixture shall be laid upon an approved surface, and shall be spread and struck off to the grade and elevation established. Bituminous pavers shall be used to distribute the mixture either over the entire width or over such partial width as may be practicable.
- B. The forward rate of travel of the paving machine(s) shall be regulated to a speed dependent upon the capacity of the mixing plant to furnish the mixture and the rate at which the rollers can obtain the required compaction. The machine shall be operated so that material does not accumulate and remain along the sides of the receiving hopper.
- C. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impracticable, the mixture shall be spread, raked, and compacted by hand tools. For such areas, the mixture shall be dumped, spread, and screeded to give the required compacted thickness, correct grade, and cross section.
- D. The Contractor may windrow plantmixed bituminous base or surface material in front of the spreading and finishing machine, provided that the following conditions and requirements are strictly adhered to:

1. The windrow is properly sized, thereby ensuring the delivery of the correct amount of material to the spreading and finishing machine at all times.
 2. The bituminous mixture shall be transferred from the windrow to the spreading and finishing machine in such a manner that the materials in the spreading machine will be a uniform mixture. The base upon which the windrow was formed shall not be disturbed, and there shall be no paving material remaining on this base between the pickup device and the spreading and finishing machine.
 3. The temperature requirements for the material in the hopper of the spreading and finishing machine are complied with. Plantmix bituminous mixture that does not meet the minimum temperatures specified shall not be incorporated in the work, but shall be wasted in a manner satisfactory to the Engineer.
- E. Should any course of bituminous mixture placed by utilizing a windrow be inferior, as determined by the Engineer, to that placed by transferring the bituminous mixture directly from the hauling vehicle to the spreading machine, the use of a windrow shall be discontinued.
- F. The bituminous mixture spread through the paving machine during one day's operation shall come from a single plant manufacturer. Intermixing from more than one source shall not be allowed.

401.03.11 ROLLING AND COMPACTION

- A. The initial or breakdown rolling shall consist of one complete coverage of the bituminous mixture with a steel-wheeled roller.
1. Initial rolling shall commence at the lower edge and shall progress toward the highest portion of the roadbed.
 2. Under no circumstances shall the center be rolled first.
- B. The initial or breakdown rolling shall be followed by rolling such that uniform density is obtained throughout the depth of the layer of the material being compacted.
1. At least two rollers, one steel-wheeled, the other pneumatic-tired, shall be used.
 2. The total number of rollers used shall be sufficient to obtain the required compaction while the mixture is in a workable condition.
- C. The final rolling of the bituminous mixture shall be performed with the same type of roller used for breakdown rolling.
- D. Rolling shall be performed in such a manner that cracking, shoving, or displacement will be avoided.
1. All rollers shall be in good condition and the reversing mechanism maintained so that the roller is capable of changing directions smoothly.
 2. The roller shall be kept in continuous motion while rolling so that all parts of the pavement receive equal compression.
 3. The motion of the roller shall be slow enough at all times to avoid displacement of the pavement.
 4. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected immediately by the use of rakes and fresh mixture when required.

- E. To prevent adhesion of the mixture to the roller, the wheels shall be kept properly maintained.
 - 1. The use of diesel oil on pneumatic-tired rollers shall be kept to a minimum as determined by the Engineer.
 - 2. Preferably, a water soluble oil or an asphalt release agent shall be used.

401.03.12 ACCEPTANCE SAMPLING AND TESTING OF BITUMINOUS MIXTURE

- A. At no cost to the Contracting Agency, field thickness and density determinations of the bituminous mixture shall be made in lots, each lot representing one day's placement.
 - 1. A lot shall be divided into 5 equal sublots, and 1 test shall be made for each sublot.
 - 2. The location of the field tests may be chosen on a random basis using ASTM D3665, Section 4.3, except that any random location given shall be set back 2 feet from a curb or 3 feet from an edge, joint, or seam.
 - 3. A summary of the random number chart used and the lot description shall be completed and approved by the Engineer prior to sampling and shall be included in the finished test results.
- B. Determination of the field thickness of the compacted bituminous mixture, as required by the Engineer, shall be accomplished by ASTM D3549, "Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens."
- C. Determination of the field density of the compacted bituminous mixture shall be accomplished by either of the methods listed below. In case of dispute, ASTM D1188 as modified shall govern.
 - 1. ASTM D2950, "Density of Bituminous Concrete in Place by Nuclear Method." When this method is used, the nuclear device shall first be correlated with the density of core samples.
 - 2. ASTM D1188, "Bulk Specific Gravity of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens." When this method is used, the procedure shall be modified to require the use of "Coated Specimens" (Parafilm or Paraffin) only. The use of Bulk Specific Gravity determinations by SSD (surface saturated dry) method are prohibited.
- D. The use of ASTM D2950 shall include correlation of test results to drilled cores.
 - 1. A minimum of 1 lot (one full day's production), and not less than 5 sublots, shall be used for this correlation.
 - 2. Should any nuclear test density in the first lot differ from its corresponding drilled core density by more than 3.00 percent relative compaction, a second lot shall be correlated and the average of all sublots in the first and second lots, but not less than 10 sublots, shall be used for the correlation. The 4-inch cores shall be transferred to the Engineer along with the random number generator listing station/offset locations.
- E. The theoretical maximum density of the bituminous mixture shall be determined by taking random samples of the mixture delivered to the job site and testing in accordance with ASTM D2041, "Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures."
 - 1. At least 2 theoretical maximum density determinations shall be made for each day's production of bituminous mixture used in the work.

2. If the day's production is less than 500 tons, then only 1 theoretical maximum density determination is required.
- F. As a quality control measure, the Contractor shall, at no cost to the Contracting Agency, make periodic checks of the field density of the compacted bituminous mixture at any time during paving operations. The testing performed by the Contractor may be used by the Engineer in part or in whole as the basis of acceptance in addition to the Quality Assurance testing to be done by the Engineer.
- G. The pavement thickness acceptance criteria are as listed below:
1. If the average of all measurements meets or exceeds the design thickness, with no core more than 10 percent less than the design thickness, the placement is acceptable.
 2. If there is only an isolated thin area, the limits of the area should be identified to determine if a construction resolution is necessary.
 3. If the core results indicate a consistently thin section, with no core more than 15 percent less than the design thickness and with the approval of the Engineer, the Contractor has the option of proposing a construction resolution or contributing an amount equivalent to the reduction in the asset value. Calculation of the lost asset value is accomplished with the following steps:
 - a. Determine the annual numbers of 18-kip equivalent single axle loads (ESAL), based upon the design traffic index (TI), a 20-year design life and an assumed traffic growth rate.
 - b. Calculate the composite structural number of the designed road section (i.e., the AC and aggregate base sections).
 - c. Using the average AC thickness, calculate the structural number of the constructed road section.
 - d. Determine the ESAL value that correlates with the reduced structural number.
 - e. Based upon the annual ESAL counts, determine the corresponding design life of the reduced section.
 - f. Using a 3 percent inflation factor and the unit cost of the AC (on a \$/square yard basis) determine the equivalent uniform annual cost (EUAC) of each section.
 - g. Multiply the reduction in design life by the EUAC to determine the reduced value of the pavement, on a unit cost basis.
 - h. Multiply the unit cost by the pavement area.
 - i. As an alternative, use the following unit cost values for the 4 road classifications (dollars per square yard per inch deviation from design thickness): Residential = \$6.97, Minor Collector = \$7.10, Major Collector = \$6.14, and Arterial = \$7.20.
 4. If the core results yield an average thickness greater than the design thickness, but are alternately very high and very low (more than 10 percent out), the Engineer may reject the placement.
- H. The pavement density acceptance criteria for production placements shall be as listed below, otherwise specified in the project plans or contract documents:

1. The average density for Residential roadway pavement shall be 92 percent $\pm$ 2.0 percent (90.0 percent - 94.0 percent), with no single density deviating more than 4 percentage points (all measurements between 88 percent - 96 percent). If the average is between 2.0 percent - 4.0 percent out (88 percent - 90.0 percent or 94.0 percent - 96 percent), with no density more than 5.0 percent out (all measurements between 87 percent - 97 percent), the Contractor has the option of contributing the lost asset value of \$1.22 per square yard per percentage point deviation from the acceptance range.
2. The average density for Minor Collector roadway pavement shall be 93.0 percent $\pm$ 2.0 percent (91.0 percent - 95.0 percent), with no single density deviating more than 4 percentage points (all measurements between 89 percent - 97 percent). If the average is between 2.0 percent - 4.0 percent out (89 percent - 91.0 percent or 95 percent - 97 percent), with no density more than 5.0 percent out (all measurements between 88 percent - 98 percent), the Contractor has the option of contributing the lost asset value of \$1.22 per square yard per percentage point deviation from the acceptance range.
3. The average density for Major Collector roadway pavement shall be 93.0 percent $\pm$ 1.5 percent (91.5 percent - 94.5 percent), with no single density deviating more than 4 percentage points (all measurements between 89 percent - 97 percent). If the average is between 1.5 percent - 4.0 percent out (89 percent - 91.5 percent or 94.5 percent - 97 percent), with no density more than 5.0 percent out (all measurements between 88 percent - 98 percent), the Contractor has the option of contributing the lost asset value of \$0.81 per square yard per percentage point deviation from the acceptance range.
4. The average density for Arterial roadway pavement shall be 93.0 percent $\pm$ 1.5 percent (91.5 percent - 94.5 percent), with no single density deviating more than 4 percentage points (all measurements between 89 percent - 97 percent). If the average is between 1.5 percent - 4.0 percent out (89 percent - 91.5 percent or 94.5 percent - 97 percent), with no density more than 5.0 percent out (all measurements between 88 percent - 98 percent), the Contractor has the option of contributing the lost asset value of \$0.81 per square yard per percentage point deviation from the acceptance range.

401.03.13 MAINTAINING TRAFFIC

- A. Traffic shall not be allowed on newly placed pavement for at least 24 hours or until the bituminous paving mix in-place temperature has dropped below 104 degrees F.
- B. Exceptions shall be made at the discretion of the Engineer. Artificial means to reduce the pavement temperature may be used as approved by the Engineer.

401.03.14 JOINTS

- A. Placing of the bituminous paving shall be as continuous as possible.
 1. Rollers shall not pass over the unprotected end of the freshly laid mixture unless authorized by the Engineer.
 2. Transverse joints shall be conformed by cutting back on the previous run to expose the full depth of the course.
 3. A brush coat of asphalt emulsion shall be used on contact surface of transverse joints just before additional mixture is placed against the previously rolled material.

- B. Longitudinal joints shall be spaced so that joints in succeeding courses will be at least 6 inches horizontally from joints in any preceding course. Lanes will be evened up each day to eliminate cold longitudinal joints insofar as practicable.
- C. Transverse joints shall be spaced so that joints in succeeding courses will be a minimum of 5 feet horizontally from joints in any adjacent course. Lanes shall be evened up each day to eliminate cold transverse joints insofar as practicable.
- D. Comply with **Subsection [401.03.10](#), "Spreading and Finishing."**

401.03.15 SURFACE TOLERANCES

- A. Surface tolerances will be specified under the respective sections of bituminous pavement.

401.03.16 SURFACING MISCELLANEOUS AREAS

- A. Surfacing of road approaches and connections, street intersection areas, frontage roads, island areas, sidewalks, dikes, curbs, gutters, gutter flares, ditches, downdrains, spillways, aprons at the ends of drainage structures, and other designated areas outside the travelled way shall conform to the provisions specified in these specifications.
- B. The combined aggregate grading for bituminous mixtures placed on miscellaneous areas shall conform to that specified for the bituminous mixture placed on the travelled way, except the aggregates used in the construction of island areas and dikes shall be constructed of aggregate conforming to the requirements of Plantmix Surface Aggregate, Type 3.
 - 1. The amount of bituminous material used in the bituminous mixture placed in dikes, gutters, gutter flares, downdrains, spillways, aprons at the end of drainage structures, and other designated areas outside the travelled ways shall be increased not less than 1 percent by weight of the aggregate over the amount of bituminous material used in the bituminous mixture placed on the travelled way.
 - 2. Submittal of a revised job-mix formula will not be necessary.
- C. The bituminous mixture placed in island areas, sidewalks, dikes, gutters, gutter flares, ditches, downdrains, spillways, aprons at the end of drainage structures, and other designated areas outside the travelled way may be spread in 1 layer. The material shall be compacted to the required lines, grades, cross section, and density requirements for Category II pavements in accordance with **Subsection [401.03.12](#), "Acceptance Sampling and Testing of Bituminous Material."**
- D. Dikes shall be shaped and compacted with an extrusion machine or other equipment capable of shaping and compacting the material to the required correct grade and cross section.

04METHOD OF MEASUREMENT

401.04.01 MEASUREMENT

- A. The quantity of bituminous plantmix to be measured for payment shall be the number of tons used in the accepted work, and will be determined by weighing the completed mixture of aggregate, mineral filler if required, and bituminous material.
- B. The quantity of shoulder dikes constructed of bituminous plantmix to be measured for payment shall be the number of linear feet and will be determined from measurement taken along the top of the completed dikes to the nearest 1-foot length.

- C. All measurements will be made in accordance with **Subsection 109.01, "Measurement of Quantities."** Batch weights will not be permitted as a method of measurement unless the alternate provisions of **Subsection 401.03.01.D.1, "Plant Scales,"** are met, in which case the cumulative weight of all the acceptable batches will be used for payment.
- D. Due to possible variations in the specific gravity and voids of the payment, the tonnage used may vary from the proposal quantities and no adjustment in contract unit price will be made because of such variation.

05BASIS OF PAYMENT

401.05.01 PAYMENT

- A. All accepted work and materials measured as prescribed above will be paid for as provided in the representative sections for each type specified.
- B. Full compensation for furnishing and applying bituminous material or asphaltic emulsion as provided for in **Subsection 401.03.06, "Preparation of Existing Surface,"** including tack coat, and **Subsection 401.03.14, "Joints,"** shall be considered as included in the contract price paid for the principal items involved and no further compensation will be allowed.
- C. When bituminous plantmix, Type III, is used in the construction of island areas or dikes, and there is no separate payment for said mixture, this bituminous plantmix shall be included in the payment for plantmix bituminous surface of the major type shown in the list of bid items and the proposal.

SECTION 406

PRIME COAT

DESCRIPTION

406.01.01 GENERAL

- A. This work shall consist of preparing and treating an existing aggregate base with bituminous material, and blotter material, if required, in accordance with these specifications and in conformity with the lines shown on the plans or established by the Engineer.

MATERIAL

406.02.01 BITUMINOUS MATERIAL

- ~~A-1. The Unless otherwise specified, the type and grade of bituminous bituminous material shall be MC-70 liquid asphalt unless otherwise specified in the Special Provisions. The grade may be changed 1 step by the Engineer during construction. Eprime, "TopeinS," or other equivalent material approved by the Engineer.~~
- ~~B.~~ The bituminous material shall meet the applicable requirements of **Section 703, "Bituminous Material."**~~the vendor.~~
- ~~B-C.~~ The bituminous material may be conditionally accepted at the source.

406.02.02 SAND BLOTTER

- A. Sand blotter shall meet the requirements of **Subsection 705.03.06, "Sand Blotter."** The material may be accepted in the stockpile at the source.

03CONSTRUCTION

406.03.01 EQUIPMENT

- A. The Contractor shall provide equipment for heating and applying the bituminous material and for applying blotter material.
- B. The equipment shall meet the requirements of **Subsection 405.03.01, "Equipment."**

406.03.02 WEATHER LIMITATIONS

- A. Bituminous material shall not be applied:
1. On a wet surface that has free-standing water.
 2. When the atmospheric temperature is below 50 degrees F.
 3. When weather conditions, in the opinion of the Engineer, would prevent the proper construction of the prime coat.

406.03.03 PREPARATION OF SURFACE

- A. The surface upon which the bituminous prime coat is to be placed shall conform to the established lines and grades, shall be smooth and uniform, and shall be compacted to the required density.

- B. If the required density deteriorates between the time the gravel course was compacted originally and the time the prime coat is placed, for any reason whatsoever, then the surface shall be recompact to the required density at no additional cost to the Contracting Agency.
- C. When required by the Engineer, an application of water shall be applied immediately before bituminous application.

406.03.04 APPLICATION OF BITUMINOUS MATERIAL

- A. Bituminous material shall be applied to the width of the section to be primed by means of a pressure distributor in a uniform, continuous spread.
 - 1. When traffic is maintained, not more than 1/2 of the width of the section shall be treated in one application.
 - 2. Care shall be taken that the application of bituminous material at the junctions of spreads is not in excess of the specified amount.
 - 3. Excess bituminous material shall be squeegeed from the surface.
 - 4. Skipped areas or deficiencies shall be corrected.
- B. When traffic is maintained, 1-way traffic shall be permitted on the untreated portion of the roadbed.
- C. As soon as the bituminous material has been absorbed by the surface and will not pick up, traffic shall be transferred to the treated portion and the remaining width of the section shall be primed.
- D. Application rate shall be ~~between 0.10 and 0.25 gallon per square yard in accordance with the vendor recommendation.~~ The Contractor shall provide to the Engineer the Contractor's calculations for the application rate that was applied.
- E. The minimum temperature requirement for TopeinS and Eprime placement is 50 degrees (°F) and rising, or as approved by the Engineer. The temperature requirements pertaining to the application of other liquid asphalts and asphaltic emulsions shall conform to the requirements of the following Table 1:

**TABLE 1
SPRAYING TEMPERATURES OF LIQUID ASPHALTS
AND ASPHALTIC EMULSIONS**

Grade & Type RC, MC, & SC	Distributor Spraying Temperatures	
	Minimum °F	Maximum °F
70	120	180
255	165	220
800	200	255
3000	235	290
Grade of Asphalt Emulsion		
RS-1, CRS -1	75	130
RS-2, CRS-2	110	160
SS-1, CSS-1	75	130
SS-1h, CSS-1h	75	130

CMS-2S

100

160

406.03.05 APPLICATION OF BLOTTER MATERIAL

- A. If, after the application of the prime coat, the bituminous material fails to penetrate within 24 hours, blotter material may be spread in the amounts required to absorb any excess bituminous material.
- B. Excess sand blotter shall be removed prior to the placement of the subsequent courses.

406.03.06 MAINTENANCE

- A. All loose sand shall be completely removed from the treated areas before placing any pavement or surfacing material thereon.
- B. Immediately in advance of placing asphalt concrete or asphalt concrete base, additional prime coat shall be applied as directed by the Engineer to areas where the prime coat has been damaged, and loose or extraneous material shall be removed, and no additional compensation will be allowed therefor.

04METHOD OF MEASUREMENT**406.04.01 MEASUREMENT**

- A. The quantity of bituminous material to be measured for payment will be the number of square yards or the number of tons conforming to all the requirements in the completed work.
- B. The quantity of sand blotter measured for payment will be the number of tons conforming to all the requirements in the completed work.
- C. All measurements will be made in accordance with **Subsection [109.01](#), "Measurement of Quantities."**

05BASIS OF PAYMENT**406.05.01 PAYMENT**

- A. The accepted quantity of materials measured as provided in **Subsection [406.04.01](#), "Measurement,"** will be paid for at the contract unit price bid per ton or square yard for bituminous material and per ton for sand blotter.
- B. When sand blotter is not included in the proposal and it is needed to protect the work or public traffic, sand blotter shall be considered subsidiary to other items of work and no additional compensation will be allowed.
- C. The above prices shall be full compensation for furnishing the material, mixing, loading, hauling, placing, and incidentals necessary for doing all of the work involved in placing prime coat and sand blotter as shown on the plans or established by the Engineer.
- D. The Contracting Agency reserves the right to increase or to omit all or any part of the estimated amount of blotter material or bituminous material to be used and no adjustment in unit price will be allowed by reason of such increase or decrease.
- E. When an item for prime coat does not appear in the proposals, but is shown on the plans or Standard Drawings, prime coat will be considered as incidental to the subsequent paving and compensation shall be included in the contract prices for other items of work.

- F. All payments will be made in accordance with **Subsection [109.02](#), "Scope of Payment."**
- G. Payment will be made under:

PAY ITEM	PAY UNIT
Liquid Asphalt Prime Coat (Type).....	Ton, Square Yard
Sand Blotter	Ton

SECTION 501**PORTLAND CEMENT CONCRETE****DESCRIPTION****501.01.01 GENERAL**

- A. This work shall consist of Portland cement, fine aggregate, coarse aggregate, water and when specified, an air entraining admixture, proportioned, mixed, placed, and cured as herein specified. All concrete shall meet the most current requirements of American Concrete Institute (ACI) with the following additions and/or exceptions indicated in this specification.
- B. As used in this section, the term Portland Cement shall be considered synonymous with the term Hydraulic Cement.
- B-C. The use of mobile mix concrete as specified herein shall require prior written approval by the Contracting Agency.

501.01.02 QUALITY CONTROL TESTING AND INSPECTION

- A. The testing and inspection of Portland cement concrete shall comply with this specification. The inspection of the mixing plant shall comply with the ACI 311, Chapter 2. In Clark County unincorporated areas and if required by other Contracting Agencies, all field and laboratory sampling and testing for project control shall be performed by NAQTC or ACI certified technicians in an AASHTO Materials Reference Laboratory (AMRL) and Cement and Concrete Reference Laboratory (CCRL), or Construction Materials Engineering Council (CMEC) R-18 AASHTO or A2LA accredited laboratory. The accreditation shall extend to the test method used on the particular project. The accreditation shall include ASTM C1077. The concrete designs shall comply with Tables 1 and 2 and the IQAC website http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx or comply with Contracting Agency requirements.
- B. Testing reports shall be promptly distributed to the owner, licensed design professional responsible for the design, Contractor, appropriate subcontractors, appropriate suppliers, and building official to allow timely identification of either compliance or the need for corrective action.
- B-C. For non-structural mobile mix concrete, the testing shall be a minimum of one set per week. The testing type and frequency shall conform to the tables on the IQAC website.

02MATERIALS**501.02.01 GENERAL**

- A. Materials shall meet the requirements of the following sections and subsections:

Materials	Section
<i>Aggregate for Portland Cement Products</i>	<u>706</u>
<i>Concrete Curing Materials and Admixtures</i>	<u>702</u>

Materials	Section
<i>Hydraulic Cement</i>	<u>701</u>
<i>Water</i>	<u>722</u>

501.02.02 GRADATION REQUIREMENTS

- A. Refer to ACI 304R Chapters 2.1 and 2.2, and comply with the gradation requirements specified in **Section [706](#), "Aggregates for Portland Cement Products,"** and the following:
1. The gradation requirements represent the extreme limits in determining the suitability of material. The gradation from any one source shall maintain a uniformity such that variations in the fineness modulus will not exceed 0.2 from the "Base Fineness Modulus."
 - a. The "Base Fineness Modulus" shall be the average of the most recent 10 fineness modulus values (or the average of all preceding values if less than 10 have been completed) from any one source.
 - b. Fine aggregate from any one source having a variation in fineness modulus exceeding ± 0.2 as prescribed above will be rejected, or at the discretion of the Engineer, may be accepted subject to approved changes.
 - c. The fineness modulus of fine aggregate shall be determined by adding the cumulative percentages, by weight, of material retained on each of U.S. Standard sieves No. 4, No. 8, No. 16, No. 30, No. 50, and No. 100, and dividing by 100.
 2. Fine aggregates from different sources of supply shall not be mixed or stored in the same stockpile and shall not be used alternately in the same class of construction or job mix without written permission. Such permission will be contingent on amending the job mix and batch masses as necessary to protect the quality of the concrete produced.
 3. If the fine aggregate for a job mix is to be a composite material from 2 or more sources, material from respective sources shall be blended by methods that will maintain the degree of uniformity of gradation required by these specifications.
 4. Adequate supplies of aggregate shall be produced and stockpiled sufficiently in advance of construction operations to permit sampling and testing before use.
 5. Coarse aggregates which vary in gradation shall be placed in separate stockpiles or bins and recombined in approved proportions. Different sizes of aggregates shall be stored in stockpiles sufficiently removed from each other to prevent the materials from becoming intermixed.
 6. If the Contractor changes the source of any size of aggregate, a new mix design shall be submitted to the Engineer for approval.

501.02.03 ADMIXTURES

- A. Refer to ACI 212. Air-entraining admixtures and water reducers and retarders shall conform to the requirements of **Subsection [702.03.02](#), "Air-Entraining Admixtures,"** and **Subsection [702.03.03](#), "Admixtures Other Than Air-Entraining."**
- B. Admixtures that are not listed in the mix design shall not be used without written permission from the Engineer, except as otherwise provided in these specifications or in the Special Provisions.

- C. Admixtures used in Class EA Concrete, Modified shall be an approved chemical admixture for concrete, meeting the requirements of ASTM C494. Use Type "A" admixture when the anticipated high temperature for the day is 80 degrees F or below. Type "D" admixture shall be used when the anticipated high temperature is above 80 degrees F. The water-cement ratio shall not be adjusted once the chemical admixture has been incorporated into the mix.
- D. Admixtures shall not be used to replace cement. Admixtures containing chlorides as Cl⁻ in excess of 1 percent by weight shall not be used in prestressed concrete. If admixtures are used to entrain air, to reduce the water-cement ratio, to retard or accelerate setting time, or to accelerate the development of strength, the admixtures shall be used at the dosage specified in the mix design, or in the contract documents, or as provided by the Engineer.
- E. When the use of an air-entraining agent is specified, it shall be added in a quantity conforming to Table 2 in **Subsection 501.03.04, "Classifications and Proportions."** It shall be measured into each batch by equipment and methods approved by the Engineer. Adjustments shall be made in the weights of the aggregates used per batch to compensate for increased yield due to air-entrainment so that the quantities of cement per cubic yard of concrete remain constant. Such adjustments shall be made by decreasing the weight of fine aggregate without changing the weight of coarse aggregate unless otherwise approved by the Engineer.
- F. When a High Range Water Reducing admixture is used, the initial slump is waived and the slump of the concrete after the admixture is added shall not exceed 8 inches.
- G. Admixtures shall be measured accurately into each batch by methods approved by the Engineer.
- H. Except as otherwise provided for air-entraining agents, samples of admixtures proposed for use shall be submitted by the Contractor to the Engineer in advance of intended use to permit tests to be made to determine compliance with claimed properties.
- I. Any type of admixture shall be uniform throughout its use in the work. Should it be found that the admixture as furnished is not uniform, its use shall be discontinued.
- J. Admixtures shall be dispensed in liquid form. Dispensers for admixtures shall have sufficient capacity to measure at one time the full quantity required for each batch. Unless admixtures are added to premeasured water for the batch, their discharge into the batch shall be arranged to flow uniformly into the stream of water. Dosages of admixtures shall not vary from the dosage indicated in the mix design or as approved by the Engineer by more than 5 percent, with the exception of air entraining admixtures where the dosage is required to achieve the specified range. Equipment for measurement shall be designed for convenient confirmation of the accuracy of measurement. If more than one admixture is used, each shall be dispensed by separate equipment unless otherwise permitted in writing by the Engineer.
- K. When water-reducing agents or water-reducing retarders are used, the permitted dosage of the admixture shall not exceed that which will result in an increase in the drying shrinkage of the concrete of 20 percent when used in precast, prestressed concrete; 10 percent when used in cast-in-place prestressed concrete; 10 percent when used in cast-in-place reinforced concrete; or 3 percent when used in non-reinforced concrete pavements.
- L. Water reducers shall reduce the water demand of concrete for a given slump at least 7 percent when used at the maximum dosage recommended by the manufacturer. Set retarders shall not be used in greater dosages than those recommended by the manufacturer, nor more than that needed to obtain the desired retardation. The strength of

the concrete containing the admixture in the amount approved by the Engineer shall at the age of 48 hours and longer, be not less than that of similar concrete without the admixture.

- M. When the Contractor proposes to use an air-entraining admixture which has been previously approved, the Contractor shall submit a certification stating that the admixture is the same as that previously approved.
- N. If an admixture offered for use is essentially the same (with only minor differences in concentration) as another previously approved material, a certification will be required stating that the product is essentially the same as the approved admixture and that no other admixture or chemical agent is present.
- O. Before or during construction, the Engineer may require that the admixture selected be further tested to determine its effect upon the strength of the concrete. The 7-day compressive strength of concrete containing the admixture under test shall not be less than 88 percent of the strength of concrete made with the same materials, the same cement content, and consistency, but without the admixtures.
- P. Subject to the following conditions, pozzolan conforming to ***Subsection 702.03.04, "Pozzolans (Fly Ash),"*** shall be used to a minimum of 20 percent and a maximum of 35 percent, by weight, of the required Portland cement in concrete, or as required by the Engineer.
 - 1. The replacement of cement with pozzolan shall be at a rate of 1 pound of pozzolan for each pound of Portland cement.
 - 2. Silica fume may be used to replace 3 percent to 7 percent, by weight, of the total cementitious material.
 - 3. Store pozzolan in separate weather-tight facilities.

501.02.04 CONCRETE MAKING PROPERTIES

- A. The mix design procedure shall comply with the method indicated on the IQAC website (see ***Subsection 501.01.02, "Quality Control Testing and Inspection"***). The type of cement permitted, the minimum sacks of cement required, and the maximum water/cement ratio shall be as shown in Table 1.

Table 1 - Cements Permitted, Sack Requirements, and W/C Ratio		
Type of Cement Permitted	Minimum Sacks of Cement Per Cubic Yard ³	Maximum Water/Cement Ratio
Type II & Fly Ash	6.5 ^{2, 3}	0.45
Type MS & Fly Ash	6.5 ^{1, 2}	0.45
Type 1-P (MS)	6.5	0.45
Type V	6.5 ³	0.45
Type HS	6.5 ²	0.45
Type V & Fly Ash	6.0 ^{2, 3}	0.45
Type HS & Fly Ash	6.0 ^{1, 3}	0.45

¹ Maximum of 8 sacks.

² Sacks per cubic yard before replacement with fly ash.

³ 5.0 sacks per cubic yard for precast products, pipe and box, with zero slump mix design.

- B. The testing frequency shall comply with the Contracting Agency requirements or the Special Provisions.
- C. Prior to mix design approval, the Contracting Agency reserves the right to verify the mix design test results, using the sources and proportions of materials as indicated by the mix design.
- D. The mix design submittal shall include the information indicated in the concrete design report form on the IQAC website. For mobile mix trucks, the design shall include the model of the mixer with serial number. Each truck shall have a mix design.

501.02.05 ZERO SLUMP CONCRETE FOR THE MANUFACTURING OF PRECAST CONCRETE PRODUCTS

- A. Concrete products manufactured by the zero slump method shall comply with **Subsection 501.02.03, "Admixtures"** and **Subsection 501.02.04, "Concrete Making Properties."** Zero slump concrete shall also exhibit design and performance requirements meeting IQAC and relevant ASTM specifications. Air entrainment is not required in a dry cast manufacturing process.
- B. For zero slump concrete, all other parts of this section do not apply.

501.02.06 LOW SLUMP CONCRETE FOR THE MANUFACTURING OF EXTRUDED SLIP FORM CONCRETE

- A. Extruded slip form concrete shall comply with material requirements contained in Table 1, above, and with design and performance requirements meeting IQAC and relevant ACI specifications. The plastic properties may be adjusted on-site with an appropriate type admixture to ensure compliance with **Subsection 501.03.04, "Classification and Proportions,"** and to aid Contractor in placement and finishing of low slump slip form concrete.

501.02.07 SELF-CONSOLIDATING CONCRETE

- A. The Contractor's use of self-consolidating concrete shall require the approval of the Engineer and shall be subject to the following requirements:
 1. Substitutions. Class S concrete may be substituted for selected applications for classes A, D, Modified A, and Modified D; and Class SA concrete may be substituted for selected applications for classes AA, DA, PAA, Modified AA, and Modified DA, as approved by the Engineer.
 2. Trial Placement.
 - a. The Contractor shall submit details of a representative test section (mockup) for approval.
 - b. Produce a trial batch of classes S and SA concrete, conforming to the proposed mix design.
 - c. As part of the concrete placement demonstration, provide the labor, equipment, and materials to test the concrete. Evaluate the mixture for strength, air content, slump flow, visual stability index, J-ring value, and hardened visual stability index.
 - d. Place a test section when the atmospheric conditions approximate the conditions anticipated for placing the final work. Finish and cure the mockup according to this section.

- e. If it is determined that the trial batch is not workable or not able to be properly placed or finished, modify the mix design or batching sequence. Submit the revised mix design and batching sequence to the Engineer, and place another test section. Repeat the submittal and trial pour process until a workable and finished trial batch is produced.
 - f. Do not place any Class S and SA concrete until the Engineer accepts the mockup pour.
 - g. A new mix design and a new trial pour will be required whenever there is a change in the source of any component material.
 - h. Segregated concrete, as determined by NV Test Method SCC-2, shall not be incorporated into any component of the anticipated concrete work.
 - i. When a truck mixer or agitator is used for transporting concrete, deliver the concrete to the site of the work and complete discharge within 60 minutes after the introduction of the mixing water to the cement and aggregates, or the introduction of the cement to the aggregates. In hot weather, or under conditions contributing to quick stiffening of the concrete, a mixing and delivery time of less than 60 minutes may be required. A mixing and delivery time exceeding 60 minutes may be approved by the Engineer if a trial pour is performed with satisfactory results.
 - j. Place each successive batch within a maximum time interval of 20 minutes. Place the concrete in continuous layers. When it is necessary by reason of emergency or other delay, to place less than a complete horizontal layer in one operation, terminate each layer by using a vertical bulkhead. Do not rod or vibrate the concrete to attempt restoring the fluidity to the mix. Plan and regulate the delivery of concrete so that minor interruptions due to form repair, material testing, etc. will not impact the required 20-minute time interval between successive placements.
3. Concrete Slump Requirements. Except for concrete used in drilled shafts, the requirements of NV Test Method T438 will be performed at 2 hours, 3 hours, or for extended times depending on the concrete placement duration.
 4. Drilled Shafts. Use Class S or SA concrete for drilled shaft construction. Upper portions of drilled shafts (top of shaft down to bottom of embedded vertical column reinforcing) may be constructed using the column concrete mix.

03CONSTRUCTION

501.03.01 EQUIPMENT

- A. With the exception of items indicated in **Subsection 501.03.05, "Proportioning Methods,"** and **Subsection 501.03.06, "Machine Mixing,"** the measurement of materials and batching shall comply to the ACI 304R, Chapters 3 and 4 recommendations and those in this section or as approved by the Engineer.
 1. Certify concrete production facilities and delivery equipment by complying with National Ready-Mix Concrete Association certification requirements.
 2. Methods employed in performing the work and all equipment, tools, and machinery used for handling materials and executing any part of the work shall be subject to the approval of the Engineer.

3. All equipment necessary shall be on hand and approved before concrete operations are begun by the Contractor.
- B. Provide adequate internal vibrating equipment, including power, to enable the Engineer to fabricate concrete cylinders for testing purposes.
- C. Furnish internal vibrators with rigid or flexible shafts, preferably powered by electric motors, capable of operating at a frequency of 7,000 vibrations per minute or greater.
 1. The outside diameter or the side dimensions of the vibrating element shall be at least 3/4 inch and not greater than 1-1/2 inches.
 2. The length of the shaft shall be at least 24 inches.
- D. The Contractor shall maintain the equipment in good condition and adjustment. Concrete mixers and other equipment which are not adequate or suitable for the work shall be removed and suitable equipment shall be provided by the Contractor.

501.03.02 PROTECTING AND SAMPLING CEMENT

- A. Suitable means of storing and protecting the cement against moisture or other injurious effects shall be provided by the Contractor. Sacked or bulk cement which, for any reason, has become partially set or which contains lumps of caked cement shall be rejected and shall be immediately removed from the worksite.
- B. Different brands of cement shall not be mixed during use or in storage, nor shall different brands be used alternately in any one structure. The same brand and kind of cement shall be used in a given structure above the ground line. A change in brand of cement will require a new mix design.
- C. The sacked cement shall be so piled as to permit access for tally, inspection, and identification of each shipment.
- D. The Contractor shall obtain from the cement company from which the cement is purchased, a certificate stating that the cement delivered to the work complies with the specifications for the type of cement specified for use, with tests pertaining to the delivered lot. The certificate shall be dated, signed, and indicate the quantity of shipment. Two copies shall be delivered directly to the Engineer.
- E. Upon receipt of the certificate of compliance, the Engineer may permit the use of the cement. When a certificate of compliance is not furnished to the Engineer, the cement shall not be used in the work until a release for its use has been received by the Contractor from the Engineer.
- F. Whenever it is determined by a laboratory test of mill or field samples that the cement does not comply with the specifications, the use of that cement will be suspended until tests by a third party paid for by the Contractor can be made and the test results are approved by the Engineer.
- G. All cement not conforming to the specifications and all cement damaged by exposure to moisture shall be removed immediately and permanently from the work.

501.03.03 STORAGE OF AGGREGATES

- A. Refer to ACI 304R, Chapter 2.2.3. The handling and storage of aggregates shall be such as to prevent segregation or contamination by foreign materials.
- B. Maintain aggregate stockpiles in saturated surface dry condition.

- C. In placing materials in storage or in moving materials from storage to the mixer, any method which may cause the segregation, degradation, or the combining of material of different gradings which will result in any stockpile or bunker material failing to meet specified requirements shall be discontinued and the materials shall be reprocessed or wasted.

501.03.04 CLASSIFICATION AND PROPORTIONS

- A. For non-commercial sources, the Contractor shall notify the Engineer not less than 30 calendar days in advance of use of the proposed sources of materials and shall make arrangements for the Engineer to obtain samples as required for testing purposes.
1. The sources of materials to be used on a project shall not be changed during the job except with the written consent of the Engineer.
 2. If permission to change sources of material is granted, a new job mix formula shall be required.
 3. Samples shall not exceed 500 pounds for each separate grading.
- B. When requested by the Contractor, exceptions to the above requirement may be granted in writing by the Engineer under either of the following conditions:
1. The concrete structures on the project are minor in nature, such as culvert headwalls, manholes, small boxes, sidewalks, etc., generally, when less than 100 cubic yards of concrete are called for on the project.
 2. When the aggregate source has been previously tested within the past 1 year and accepted by the Contracting Agency.
- C. The Contractor shall give the Engineer advance notice in writing when any changes are to be made in the batch proportions. In the case of Class EA concrete, no changes will be allowed without new laboratory trial testing and subsequent approval.
- D. Batches of concrete shall not vary more than ± 3 pounds per cubic foot in unit weight from design mix. The cement factor of any individual batch placed in the work shall not be more than 14 pounds per cubic yard less, nor more than 23 pounds per cubic yard greater than the designated cement factor. Batch aggregates and report by weight to the Engineer. The weights used may be varied as necessary to comply with the above tolerances in cement factor and unit weight.
- E. For Class EA Concrete, Modified, perform laboratory trial tests to determine strength and compatibility of all materials (as specified in Table 2 of this subsection and in **Subsection 501.02.03, "Admixtures"**) to be used. Contractor shall have an approved laboratory perform the tests and furnish documentation of such tests. Laboratory trial batches may be observed by the Engineer.

Table 2 - Concrete Mix Designation ^{4, 5}							
Class of Concrete	Cementitious Range lb/yd ³	Max. Nom. Coarse Aggregate Size inches	Min. 28-Day Compressive Strength ⁶ psi	Slump Range inches	Entrained Air Range %	Unit Weight Variation lb/ft ³	Use
A	564-705	1-1/2	3000	1-4	4-7	± 3	General use and reinforced structures
AA	564-705						
B	517-705	2	3000	1-5	4-7	± 3	Massive or lightly reinforced sections
BA				1-4			
C	470-611	2-1/2	2500	1-5	4-7	± 3	Massive unreinforced and backfill
CA	517-658						
D	564-705	3/4	3000	1-4	4-7	± 3	Thin reinforced sections, hand rails, etc.
DA	564-752						
PA A	564-752	3/4	Specified on Plans	1-4	Specified on Plans	± 3	Prestressed members
Modified A and AA	564-752	1-1/2	Specified on Plans	1-4	4-7 (AA only)	± 3	Where specified on plans
Modified D and DA	564-752	3/4	Specified on Plans	1-4 ⁷	4-7 (DA only)	± 3	Where specified on plans
Modified EA ⁸	564-752	3/4	Specified on Plans	1/2 -4	4-7	± 3	High Performance Concrete
S and SA	639-925 ⁹	3/4 ¹⁰	Specified on Plans	N/A	4-7 (SA only) ¹¹	± 3	Self Consolidating Concrete

501.03.05 PROPORTIONING METHODS

- A. Except as hereinafter noted, aggregate bins shall conform to either 1 or 2 as follows:
- Each specified size of aggregates shall be stored in a separate bin. Except as hereinafter specified, each bin shall be provided with an individual outlet gate,

⁴ Blend the coarse aggregate gradation from stockpiles conforming to the requirements of **Subsection 706.03.01, "Coarse Aggregate,"** and the stated nominal maximum size. Submit test reports for trial batches showing each stockpile sieve size and the proportions used for blending. Adhere to **Subsection 706.02.01, "General,"** for the combined gradation regardless of coarse aggregate gradation. If approved, coarse aggregate nominal maximum size of 1 inch may be used in lieu of 3/4 inch.

⁵ Air entrainment on mixes placed above 6000 feet elevation

⁶ Comply with **Subsection 501.02.04, "Concrete Making Properties,"** of the Standard Specifications for the moving average method of evaluating concrete specified under Statistical Evaluation of Concrete Strength.

⁷ For extruding barrier or bridge rail, slump range is 0.5-4 inches.

⁸ Aggregates shall consist of a blend of coarse, intermediate, and fine aggregates in order to produce a dense grading. Consideration of the grading, workability factor, and coarseness factor, as outlined in ACI 302 shall be utilized. The aggregate maximum nominal size shall consist of at least a nominal 3/4 inch stone size.

⁹ The maximum shrinkage requirement of 0.06% in 28 days air dry after 28-day wet cure, ASTM C157, shall apply if the total cementitious material exceeds 752 pounds per cubic yard.

¹⁰ If approved, 1/2 inch or 3/8 inch may be used in lieu of 3/4 inch.

¹¹ Air content shall be as follows: For 1/2 inch max. aggregate size, 4.5% - 7.5%, and for 3/8 inch max. aggregate size, 5% - 8%.

designed and constructed to prevent leakage when closed. The gates shall cut off quickly and completely.

2. Each size aggregate shall be weighed individually in a single bin, providing there is a satisfactory method employed to eliminate any excess material resulting from over-charging of the bin before the material reaches the surge hopper.
- B. Conformance to 1 and 2 above will not be required when batching for culvert headwalls, manholes, small boxes, sidewalks, etc., and the total quantity of concrete called for on the project does not exceed 300 cubic yards.
 - C. All aggregates for use in Portland cement concrete shall be proportioned by weight, with the exception that aggregates for culvert headwalls, short pieces of curb and gutter, or small sections of sidewalk and related minor work may be proportioned either by weight or volume as the Contractor may elect. Measuring boxes of known capacity shall be furnished and used to measure each size of aggregate proportioned by volume.
 - D. Water shall be proportioned to maintain batching consistency with regard to stockpile moisture contents and varying absorption values for both coarse and fine aggregates. The Engineer may request the Contractor to submit a new mix design if either the coarse or fine aggregate absorption values vary from the approved mix design by more than 1 percent.
 - E. Bulk cement shall be weighed separately when the batch is 1 cubic yard or more.
 1. The scale and weigh hopper for the cement shall be separate and cement hopper shall be interlocked against opening before the full amount of cement is in the hopper, against closing before the contents of the hopper are entirely discharged and the scales are back in balance, and against opening when the amount of cement in the hopper is underweight by more than 1 percent of the amount specified.
 2. An interlock system will not be required on projects having less than 300 cubic yards in the bid schedule.
 - F. Scales utilized in the proportioning device may be of the springless dial type or of the multiple beam type.
 - G. If of the dial type, the dial shall be of such size and so arranged that it may be read easily from the operating platform.
 - H. If of the multiple beam type, the scales shall be provided with an indicator operated by the main beam which will give positive visible evidence of over or under weight.
 1. The indicator shall be so designed that it will operate during the addition of the last 400 pounds of any weighing.
 2. The over travel of the indicator hand shall be at least 1/3 of the loading travel.
 3. The indicator shall be enclosed against moisture and dust.
 - I. Weighing equipment shall be insulated against vibration or movement of other operating equipment in the plant. When the entire plant is running, the scale reading and cutoff shall not vary from the weight designated by more than 1 percent for cement and 1-1/2 percent for any size aggregate, nor 1-1/2 percent for the total aggregate in any batch.
 - J. Scales shall be approved with a certificate of inspection as required by **Subsection 109.01, "Measurement of Quantities."**
 - K. When the entire plant is running, the scale reading and cutoff weights shall not vary from the mix design by more than 1 percent for cement, fly ash, and silica fume, 1.5 percent for

- any individual size aggregate, and 1 percent for the total combined aggregate in any batch. The total water shall not exceed the maximum water specified in the mix design.
- L. Should separate supplies of aggregate and material of the same size group, but of different moisture content or specific gravity be available at the proportioning plant, withdrawals shall be made from one supply exclusively and the material therein completely exhausted before starting upon another.
 - M. Stockpiled aggregates shall be in a saturated surface dry condition just prior to batching.
 - 1. The moisture content of the aggregate shall be such that no visible separation of moisture and aggregate will take place during transportation from the proportioning plant to the point of mixing.
 - 2. Aggregate containing excess moisture shall be stockpiled prior to use until sufficiently dried to meet the above requirements.
 - N. Batches with cement in contact with damp aggregates shall be mixed within 30 minutes after being proportioned. Batch trucks hauling more than 1 batch of cement and aggregate shall be so constructed that materials do not flow from one compartment to another during haul or discharge.
 - O. Coarse and fine aggregate shall be handled and measured separately. Cement shall be emptied directly into the charging skip of the mixer. Water shall be measured either by volume or by weight.
 - P. The equipment for measuring and supplying the water to the mixer shall be so constructed and arranged that the amount of water added to the mixture can be measured in one operation into the mixing drum without dribbling.
 - 1. The equipment shall be so designed that water from the source of supply cannot enter the measuring tank while the water is being discharged from the measuring tank into the mixer.
 - 2. Tanks or other equipment for measuring and discharging water into the mixer shall be sufficiently accurate that the amount of water delivered to the mixer for any batch shall not vary more than 1 percent from the required quantity of water for any position of the mixer with respect to a level plane.
 - 3. The tanks or other equipment shall be so arranged as to permit the checking of the amount of water delivered by discharging into measured containers.

501.03.06 MACHINE MIXING

- A. Concrete manufactured by any procedure which results in any unmixed lumps of cement in the mixed product shall be rejected. The preparation of the mix shall be in accordance to ACI 318, Section 5.8, "Mixing," and this section. The Cement and Concrete terminology is defined in ACI 116.
- B. For structural concrete, the Engineer-Operator shall be provided with a computer printed legible ticket with each load of concrete delivered to the project site and for non-structural concrete, at a minimum, a hand written ticket. The ticket shall be presented with each load, which and shall contain the following information:
 - 1. Name of Vendor.
 - 2. Name of Contractor.
 - 3. Number of Cubic Yards in the Load.

4. ~~Actual Weights~~Amount of Cement and of each Size of Aggregate.
 5. Amount of Water Added at the Plant.
 6. Amount of Water in the Aggregate.
 7. Brand and Type of Cement.
 8. Brand and Amount of Admixture.
 9. Time and Date of Batching.
 10. For Mobile mixer add:
 - a. Truck Number (the truck unit the mixer is mounted).
 - ~~9.b.~~ The Model of the mixer with Serial Number.
- C. Space shall be provided on the ticket so the amount of water added on the job may be indicated.
- D. All concrete shall be mixed in mechanical mixers, except that when permitted by the Engineer, batches not exceeding 1/3 cubic yard may be mixed by hand methods in accordance with the provisions of **Subsection 501.03.07, "Hand Mixing."**
1. Mixers shall have legible permanently attached plates showing manufacturer's rated capacity, mixing speeds, and serial number.
 2. Mixers may be stationary mixers or truck mixers.
 - a. Agitators may be truck mixers operating at agitating speed or truck agitators.
 - b. Each mixer and agitator shall have attached thereto in a prominent place a metal plate or plates on which is plainly marked the various uses for which the equipment is designed, the manufacturer's guaranteed capacity of the drum or container in terms of the volume of mixed concrete, and the speed of rotation of the mixing drum or blades.
 3. The Contractor, at no additional cost to the Contracting Agency, shall furnish samples of the fresh concrete and provide safe and satisfactory facilities for obtaining the samples.
 4. Concrete mixers may be of the revolving drum or the revolving blade type and the mixing drum or blades shall be operated uniformly at the mixing speed recommended by the manufacturer.
 5. The temperature of materials as charged into the mixer shall be such that the temperature of the mixed concrete at the time it is placed in final position is not less than 50 degrees F nor more than 90 degrees F as specified in **Subsection 501.03.10.B, "Cold Weather – General,"** and **Subsection 501.03.10.C, "Low Temperature Protection."** Aggregates and water used for mixing shall not exceed 150 degrees F.
 6. Concrete for structures shall be mixed for a period of not less than 60 seconds nor more than 5 minutes after all materials, including water, are in the mixer.
 7. Cement shall be batched and charged into the mixer by means that will not result either in loss of cement due to the effect of wind, or an accumulation of cement on surfaces of conveyors or hoppers, or in other conditions which may vary the required quantity of cement in the concrete mixture.

8. Stationary mixers having a capacity of 1 cubic yard or more and all paving mixers shall be operated with an automatic timing device that can be locked by the Engineer. The time device and discharge mechanisms shall be so interlocked that during normal operations no part of the batch will be discharged until the specified mixing time has elapsed.
9. The total elapsed time between the intermingling of damp aggregates and cement and the start of mixing shall not exceed 30 minutes.
10. Mixers and agitators which have an accumulation of hard concrete or mortar or worn blades shall not be used.
11. When central-mixed concrete is furnished and non-agitating hauling equipment is used for transporting concrete to the delivery point for Portland cement concrete pavement, discharge into the laydown machine shall be completed within 45 minutes after the addition of the cement to the aggregates.

E. Ready-Mixed Concrete.

1. Ready-mixed concrete shall be central-mixed, shrink-mixed, or transit-mixed concrete. Shrink-mixed concrete is that which has been mixed partially in a stationary mixer and the mixing completed in a truck mixer.
2. The size of batch in truck mixers and truck agitators shall not exceed the rated capacity as determined by the current Standard Requirements of Truck Mixer Manufacturers Bureau. The size of batch in stationary mixers shall not exceed the rated capacity of the mixer as determined by the standard requirements of the Associated General Contractors of America. No batches requiring fractional sacks of cement will be permitted unless all of the cement is weighed when added to the batch.
3. If the use of ready-mixed concrete is approved, the producers shall use only that cement approved by the Contracting Agency for use on the project. Contracting Agency approved cement shall be stored at the concrete plant in such a manner that it can be identified and kept separate from other cement.
4. Ready-mixed concrete for structures shall be transported in truck mixers or truck agitators.
5. The mixer, when loaded to capacity, shall be capable of combining the ingredients of the concrete within the specified time, into a thoroughly mixed and uniform mass and of discharging the concrete with a satisfactory degree of uniformity. The agitator, when loaded to capacity, shall be capable of maintaining the mixed concrete in a thoroughly mixed uniform mass and of discharging the concrete with a satisfactory degree of uniformity.
6. Mixers and agitators shall be examined periodically for changes in condition due to accumulation of hardened concrete or mortar or to wear of the blades.
 - a. When any such change in condition is found, the concrete shall be subjected to the slump tests.
 - b. If the tests indicate that the concrete is not being properly mixed, the faulty equipment shall be corrected before its further use is allowed.
7. Truck mixers shall be equipped with electrically or mechanically actuated revolution counters by which the number of revolutions of the drum or blades may be readily verified. The counters shall be of the continuous-registering, non-resettable type,

which accurately register the number of revolutions, and shall be mounted on the truck mixer so that the Engineer may safely and conveniently inspect them from alongside the truck.

8. When a truck mixer is used, each batch of concrete shall be mixed for not less than 70 and no more than 100 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of the equipment as mixing speed. If any additional mixing is done, it shall be at the speed designated by the manufacturer of the equipment as agitating speed.
9. When shrink-mixed concrete is furnished, concrete that has been partially mixed at a central plant shall be transferred to a truck mixer and all requirements for transit-mixed concrete shall apply. No credit in the number of revolutions at mixing speed shall be allowed for partial mixing in a central plant.
10. No additional mixing water shall be incorporated into the concrete during hauling or after arrival at the delivery point, unless permitted by the Engineer. If the Engineer permits additional water to be incorporated into the concrete, the drum shall be revolved not less than 30 revolutions at mixing speed after the water is added and before discharge is commenced.
11. The rate of discharge of mixed concrete from truck mixer-agitators shall be controlled by the speed of revolution of the drum in the discharge direction with the discharge gate fully open.
12. When truck mixer or truck agitator is used for transporting concrete that has been completely mixed in a stationary mixer, mixing during transportation shall be at the speed designated by the manufacturer of the equipment as agitating speed. Do not exceed a total of 300 revolutions from the time of initial batching to complete discharge of delivered concrete.
13. When a truck mixer or agitator is used for transporting concrete, the concrete shall be delivered to the site of the work and discharge shall be completed within 90 minutes after the introduction of the mixing water to the cement and aggregates, or the introduction of the cement to the aggregates. In hot weather, or under conditions contributing to quick stiffening of the concrete as determined by the Engineer, a delivery time of less than 90 minutes may be required. When a truck mixer is used for the complete mixing of the concrete, the mixing operations shall begin within 30 minutes after the cement has been intermingled with the aggregate.
14. If the mixing plant is such a distance from the site of the work that it is not practical to have the mixed concrete delivered and placed in forms within the time limit specified, cement and water shall not be added until such time as requirements can be complied with.
15. The organization supplying concrete shall have sufficient plant capacity and transporting apparatus to ensure continuous delivery at the rate required.
 - a. The rate of delivery of concrete shall be used as to provide for the proper handling and placing of concrete.
 - b. An interval of more than 45 minutes between any 2 consecutive batches or loads, or a delivery and placing rate of less than 8 cubic yards of concrete per hour shall constitute cause of shutting down work for the remainder of the day, and if so ordered by the Engineer, the Contractor shall make, at no additional

cost to the Contracting Agency, a construction joint at the location and of the type directed by the Engineer in the concrete already mixed.

16. After mixing of ready-mixed concrete has been completed, it shall be agitated continuously at agitating speed until it has been discharged from the drum.
17. Wash water shall be completely discharged from the drum or mixing container before the succeeding batch is introduced. Cement balling (intermittent clumping) and mix foaming shall be prevented by controlling the batch sequence, mixing speed, and mixing time.
 - a. When intermittent clumping exceeds 1-2 clumps per yard or 10 clumps per truck, the entire load will be rejected.
 - b. The clumps shall not exceed 5 inches in diameter.

F. Mobile Mixers

1. The concrete mobile mix truck and placement of concrete shall comply to the ASTM C685 "Concrete Made by Volumetric Batching and Continuous Mixing" and Volumetric Mixer Manufacturers Bureau manual VMMB 100-01 "Volumetric Mixer Standards" with the exception as follows:
 - a. ASTM C685 section 7.8 and VMMB 100-01 section 1.2.4 tolerance table shall be replaced with American Concrete Association 3046R section 6.2.2 tolerance table.
2. Material bins shall conform to Table 1 of VMMB 100-01 with the following addition:
 - a. Reinforcing fibers and fly ash, if required, must be stored and dispensed from their own separate bin. Bins for cementitious materials shall be sealed to prevent damage to the cementitious materials by ambient air moisture.
3. Rating Plate
 - a. The rating plate shall comply to ASTM C685 and VMMB 100-01. One size of volumetric mixer units of the same design and configuration shall have been approved by the VMMB to be eligible to carry the VMMB plate.
 - b. Mixers that were certified by a VMMB member company subsequent to issue of the VMMB 100 standard in 2001 shall have a rating plate furnished by the VMMB attached to the mixer equipment. They shall be certified by completing the qualification report forms. These forms are on the VMMB website and shall be submitted to VMMB for review and approval.
 - c. Separate VMMB qualification report forms are required for each individual mixer unit.
4. Prior to the use of the mobile mixer, it shall be inspected by the Contracting Agency. At the time of the inspection, the supplier must provide all of the documentation as required in ASTM C685.
 - a. The frequency of the mixer inspection is six months.
 - b. The maximum calibration interval of the flow meter shall be six months or 2500 cubic yards of production and a minimum of three calibration runs shall be performed as required by ACI 304.6R.
 - c. Mixing uniformity evaluation must be performed on a minimum 1 cubic yard sample and reviewed and approved by the VMMB prior to delivery of a rating

plate. Prior to initial submittal of an application package to Clark County, an initial mixing uniformity evaluation must be performed within the last 3 months.

- d. A mixing uniformity evaluation must then be performed at a maximum interval of 6 months as required by ASTM Standard C685. A mixing uniformity evaluation must be performed within the last 3 months, prior to submittal of an annual application for renewal as an approved concrete fabricator with Clark County.

5. Material

- a. For onsite materials, it shall be placed in stockpiles with tests of each in accordance to the table one test methods in section 706 and frequencies on the Clark County QAQC website:
http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx
- b. For established offsite material sources, test results within 6 months of the mix design date shall be attached to the mix design based on the Table 1 requirements.
- c. The mix design shall include the source name and location. If the material source changes, the mix shall be re-designed and be resubmitted.
- d. The data shall include the material ASTM C33 information.
- e. The documentation shall be delivered to the Contracting Agency.
- b.f. The source material test data and vendor sheets shall be attached to the mix design.

501.03.07 HAND MIXING

- A. Hand mixing shall not be permitted, except in case of an emergency or under written permission of the Engineer.
- B. When permitted, hand mixing shall be done only on watertight platforms.
1. The sand shall be spread evenly over the platform and the cement spread upon it.
 2. The sand and cement shall then be thoroughly mixed while dry by means of shovels until the mixture is of uniform color, after which it shall be formed into a "crater" and water added in the amount necessary to produce mortar of the proper consistency.
 3. The material upon the outer portion of the "crater" ring shall then be shoveled to the center and the entire mass turned and sliced until a uniform consistency is produced.
 4. The coarse aggregate shall then be thoroughly wetted and added to the mortar and the entire mass turned and returned at least 6 times and until all of the stone particles are thoroughly covered with mortar and the mixture is of a uniform color and appearance.
- C. Hand mixing will not be permitted for concrete to be placed under water.
- D. Preproportioned sack concrete may be used for grout caps or other nonstructural uses as approved by the Engineer.

501.03.08 RETEMPERING

- A. Concrete shall be mixed only in such quantities as are required for immediate use and shall be placed before initial set has taken place. Any concrete in which initial set has begun shall be wasted and not used in the work.
- B. No retempering of concrete shall be allowed.

501.03.09 CURING

- A. Comply with ACI 308, Standard Specification for Curing Concrete, with the following exceptions or additions:
 - 1. **General.** All concrete shall be cured for the length of time hereinafter specified. If Type III cement is used, the curing time may be reduced as directed by the Engineer. In the event of low temperatures, the time will be increased according to the procedures specified in **Subsection [501.03.10.B](#), "Cold Weather – General."**
 - a. Cure all bridge decks and approach slabs according to **Subsection [501.03.09.A.6](#), "Bridge Deck Curing."**
 - b. Curing shall commence immediately upon completion of the finish. In the event that the application or placement of the curing medium is delayed, curing will be as described under 2 below.
 - 2. **Water Method.** The concrete shall be kept continuously wet by the application of water for a minimum period of 7 days after the concrete has been placed.
 - a. Use fogging equipment capable of applying water through an atomizing nozzle in the form of a fine mist, not a spray. The equipment may use water pumped under adequate high pressure, or a combination of air and water pumped under high pressure. Use equipment sufficiently portable for use in the direction of any prevailing wind. Adapt equipment for intermittent use as directed to prevent excessive wetting of the concrete.
 - b. Cotton mats, rugs, carpets, or earth or sand blankets may be used as a curing medium to retain the moisture during the curing period. The cotton mats, rugs, or carpets shall be of such character that they will retain water.
 - 3. **Curing Compound Method.** The entire surface of the concrete shall be sprayed uniformly with a curing compound. It shall be applied when just a light film of water is present on the surface. If the surface is dry, water shall be added as specified in 2 above before the curing compound is applied.
 - a. On decks or slabs cured by this method, foot traffic shall be held to a minimum and these surfaces shall not be used as a work area during the cure period. Should the film of the compound be damaged before the expiration of 7 days, the damaged portions shall be repaired immediately with additional compound.
 - b. Uniformly spray the entire surface of the concrete with a curing compound conforming to **Subsection [702.03.01](#), "Curing Materials,"** except as hereinafter specified for concrete bridge decks that are to be the roadway surface. The curing compound shall be applied to the exposed surface at a uniform minimal rate of 1 gallon per 150 square feet of area.
 - c. Do not apply the curing compound until all patching and surface finishing, except grinding, have been completed. When ordered during periods of hot weather, continue fogging of the concrete with water after curing compound is

applied until no longer required. Such fogging after the application of the curing compound will be paid for as extra work as provided in **Subsection 104.03, "Extra Work."**

- d. The curing compound shall be delivered to the work in ready-mixed form. At the time of use, the compound shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. The compound shall not be diluted or altered in any manner, unless dilution is recommended by the manufacturer.
- e. Provide curing compounds which remain sprayable at temperatures above 40 degrees F and do not hard settle in storage.
- f. Curing compound that has become chilled to such an extent that it is too viscous for satisfactory application shall be warmed to a temperature not exceeding 100 degrees F
- g. Curing compound shall be packaged in clean 55-gallon steel barrels or round 5-gallon steel containers or supplied from a suitable storage tank located at the jobsite.
 - 1) Each 55-gallon barrel shall be equipped with a built-in agitator having 2 sets of blades, one at the bottom and one midway between top and bottom, and with removable lids and airtight band fasteners.
 - 2) On-site storage tanks shall be kept clean and free of all contaminants. Each tank shall be provided with a permanent system designed to completely redisperse any settled material without introducing air or any other foreign substance.
 - 3) Barrels shall be filled in a manner that will prevent skinning.
 - 4) Ring seals and lug type crimp lids shall be used to seal 5-gallon containers well.
 - 5) Containers shall be provided with lining that will resist the solvent of the curing compound and will not permit skins to be loosened into the body of the curing compound.
 - 6) Each container shall be labeled with the manufacturer's name, batch number, type of compound, number of gallons, and date of manufacture. Each container shall also be labeled with an Interstate Commerce Commission Red Label warning concerning flammability. The label shall also warn that the curing compound shall be well stirred before use.
 - 7) When the curing compound is shipped in tanks or tank trucks, a shipping invoice shall be supplied with each load containing the same information as that required herein for container labels.
- h. Curing compound may be sampled by the Engineer at the source of supply, at the job site, or at both locations.
- i. Curing compound not used within 6 months of the date of manufacture will require certification from the manufacturer that the curing compound still conforms to ASTM C309. Curing compound more than 1 year old or without a manufacture date on the container will not be allowed for use.

4. Waterproof Membrane.
 - a. Keep the exposed finished surfaces of concrete damp with water using an atomizing nozzle, as specified in **Subsection 501.03.09.A.2, "Water Method,"** until the concrete has set.
 - b. Place the curing membrane after the concrete has set.
 - 1) The membrane shall be formed into sheets of such width as to provide a complete cover of the entire concrete surface.
 - 2) All joints in the sheets shall be securely cemented together in such a manner as to provide a waterproof joint.
 - 3) Overlap of sheets shall have a minimum lap of 18 inches.
 - 4) The sheets shall be securely weighted down by placing a bank of earth on the edges of sheets or by other means satisfactory to the Engineer.
 - 5) Sheeting material shall conform to **Subsection 702.03.01, "Curing Materials."**
 - c. The curing membrane shall remain in place for a period of not less than 7 days.
 - d. Should any portion of the sheets be broken or damaged before the expiration of the curing period, the broken or damaged portion shall be immediately repaired with new sheets properly cemented into place, or water curing as described above shall commence immediately.
 - e. Sections of the membrane which have lost their waterproof qualities or have been damaged to such an extent as to render them unfit for curing shall not be used.
5. Form Method.
 - a. If forms are kept on the concrete surfaces, this will be considered adequate cure for these surfaces.
 - b. However, should the forms be removed within 7 days after the concrete has been placed, one of the above methods shall be used on the exposed surfaces.
 - c. Comply with **Subsection 502.03.11, "Removal of Falsework and Forms."**
6. Bridge Deck Curing.
 - a. Submit a quality control plan for concrete placement and curing, for review and approval, a minimum of 30 days prior to the pre-pour conference for bridge decks and approach slabs. The plan shall include, but not be limited to, information on the procedures for when and how the concrete and the curing system is to be placed, frequency for monitoring, maintaining, and re-wetting the curing system chosen, and a list of personnel responsible for performing such work. Include in the plan, equipment to be used for placement of concrete and the curing system, methods of protecting the covers from displacement from wind or weather, and methods of preventing loss of heat and moisture.
 - b. Describe procedures to be followed in the event of equipment breakdown or inclement weather during concrete placement. In addition, describe the

method to be used to protect pedestrian and vehicular traffic under the structure.

- c. Use Figure 2.1.5 from ACI 305R, Hot Weather Concreting, to determine the evaporation rate. Additional protection measures shall be provided if the rate of evaporation exceeds 0.1 pound per square foot per hour.
 - 1) Accurate record of placement location, air temperature, relative humidity, concrete temperature, and wind velocity shall be provided.
 - 2) Readings shall be taken an hour prior to the concrete placement and at 1-hour increments during concrete placement, until the final curing blanket is placed.
 - 3) Required data shall be submitted to the Engineer.
- d. Concrete temperature shall be monitored during the entire curing period by utilizing recording thermocouples embedded at 1 inch below the concrete surface and 1 inch above the bottom concrete surface.
 - 1) A minimum of 2 sets of thermocouple installations will be required per each day's placement.
 - 2) The thermocouple shall be capable of recording the concrete temperature as a function of time.
 - 3) Acceptable devices include thermocouples connected to electronic data loggers.
 - 4) The recording time intervals shall be a maximum of 30 minutes.
 - 5) The recording devices shall be accurate to within ± 1.8 degrees F. Concrete temperature between the top and bottom of the slabs and the supporting girders shall be maintained to a maximum differential temperature of 30 degrees F.
 - 6) If differential temperatures exceed the requirements, measures shall be taken to correct the curing process.
 - 7) Required data shall be submitted to the Engineer.
- e. Immediately after the concrete is placed, the moisture content shall be maintained by humidifying the air directly above the concrete surface until the curing covers are placed. Fogging equipment described in **Subsection 501.03.09.A.2, "Water Method,"** shall be used, mounted on a finishing bridge that is separate from the concrete placing equipment.
- f. Begin placing pre-soaked burlap within 30 minutes after finishing has started. Wet curing of the surface shall be performed for 10 days, unless otherwise directed, with the following covering:
 - 1) Burlap and Polyethylene Covering. Burlap conforming to **Subsection 702.03.01, "Curing Materials,"** and polyethylene (white or reflective) conforming to ASTM C171 shall be furnished. Soaker hose shall be placed or other approved method shall be used to provide continuous wetting of burlap between the burlap and polyethylene covering.
- g. Pre-wetted curing coverings shall be placed with a finishing bridge. Covers shall be placed directly behind the concrete fogging operation.

- h. The covering shall be maintained uniformly wet during the entire curing period. Provide 24-hour monitoring of the wet curing for the full length of the curing period. Water temperature shall not be more or less than 20 degrees F from the temperature of top of bridge deck.
 - i. Covers shall be lapped a minimum of 18 inches. All lapped edges shall be sealed to prevent loss of heat and moisture.
 - j. If the ambient temperature drops below 45 degrees F during the first 4 days of curing, additional protection shall be provided according to **Subsection 501.03.10.C, "Low Temperature Protection."**
 - k. After completion of wet curing and removal of curing covering, immediately remove excess water and apply an application of curing compound according to **Subsection 501.03.09.A.3, "Curing Compound Method."**
 - l. All cracks on new bridge decks and approach slabs shall be repaired. Requested method of repair shall be submitted for approval.
7. Maturity Meter Method:
- a. This method may be used if referred to in the Contract Special Provisions.
 - b. The method specified in ASTM C1074 may be used in order to reduce the cure time. This method requires training and certification of the Quality Assurance and Control personnel.
 - c. This method shall not be used for acceptance but for reducing the time required for form removal. The Contractor shall have a plan of action approved by the Engineer and monitored by a third party engineer for meter placement and monitoring.

501.03.10 WEATHER LIMITATIONS

- A. **General.** If impending inclement weather conditions exist, the Contractor shall decide whether or not to begin the placement and the Contractor shall have sole responsibility for Contractor's decision.
- 1. Before any concrete is placed, the Contractor shall have adequate provisions readily available as approved by the Engineer, to protect the concrete from any impending weather conditions.
 - 2. In case precipitation should occur after placing operations have started, the Contractor shall provide ample covering to protect the work.
 - 3. The placing of concrete shall be stopped before the quantity of precipitation is sufficient to cause a flow or to wash the surface.
- B. **Cold Weather – General.** Comply with ACI 306, Cold Weather Concreting, with the following exceptions or additions:
- 1. All concrete shall be maintained at a temperature of not less than 50 degrees F for 3 days or not less than 40 degrees F for 7 days. The count of time shall commence immediately upon completion of final placement and vibration. The three 50-degree F days need not be consecutive.
 - 2. One 24-hour period shall constitute 1 day.

3. The temperature of the concrete shall be determined by placement of thermometers on the concrete surfaces and properly insulating these devices to record the surface temperature of the concrete.
 - a. Temperature shall be monitored continuously throughout the total protection time required by this subsection.
 - b. In case the surface temperature of the concrete falls below 40 degrees F for a duration of 3 hours or more in any 24-hour period during the time of temperature protection, the time shall be increased 1 day for each day this occurs.
 - c. An absolute minimum temperature of 35 degrees F shall be maintained for the total time of protection specified in this subsection.
 - d. Should the temperature of the concrete fall below 35 degrees F at any time, damage may occur.
 - e. The assessment of damage will be determined by a professional engineer registered in Nevada and paid for by the Contractor and concrete so damaged may require repair or replacement at the option of the Engineer.
 4. The concrete shall have a temperature of at least 50 degrees F and not more than 90 degrees F at the time of placing. (Also, comply with temperature constraints specified in **Subsection 501.03.06, "Machine Mixing."**)
 - a. Heating equipment or methods which alter or prevent the entrainment of the required amount of air in the concrete shall not be used.
 - b. The equipment shall be capable of heating the materials uniformly.
 - c. Aggregates and water used for mixing shall not be heated to a temperature exceeding 150 degrees F.
 - d. Concrete containing frost or lumps at the time of placing shall not be used.
 5. Stockpiled aggregates may be heated by the use of dry heat or steam. Aggregates shall not be heated directly by gas or oil flame or on sheet metal over fire.
 6. Reinforcing steel shall be free of ice, snow, and frost during placement of concrete. Concrete shall not be placed on frozen ground.
- C. **Low Temperature Protection.** Refer to guidelines in ACI 306, Cold Weather Concreting, with the following exceptions or additions:
1. **General.** After the concrete has been placed, means shall be taken to protect the concrete from any impending low temperatures.
 - a. Methods and materials not hereinafter prescribed may be used if approved by the Engineer and the following requirements adhered to:
 - 1) Materials shall be fire resistant
 - 2) Materials shall be waterproof
 - 3) Materials shall not adhere, abrade or damage the surface of the concrete.
 - b. Approval of the Engineer shall not relieve the Contractor from obtaining specification results.

2. **Insulating Blankets.**
 - a. Insulating blankets used to protect concrete from low temperatures shall be fire resistant and waterproof.
 - b. The blankets shall be secured and overlapped along the edges and joints to ensure that no opening will exist in the protection during high winds or other adverse conditions.
 - c. Provisions shall be made to allow the reading of thermometers placed inside of the protection.
 - d. When depositing concrete against previously cast concrete, the blanket insulation shall extend at least 14 inches onto the existing concrete and shall be securely held in place.
3. **Low Temperatures Protection – Heating and Housing.**
 - a. In order to meet the provisions of **Subsection 501.03.09, “Curing,”** paragraphs A and B, the concrete may be protected by applying artificial heat within an enclosure.
 - b. The enclosure shall be constructed with fire resistant material, unless otherwise directed by the Engineer, and shall be subject to Engineer's approval.
 - c. The heating system shall be so arranged as to provide uniform heating, ensuring that the concrete farthest from the source of heat is receiving adequate protection without drying the concrete near the source of heat so as to cause shrinkage cracks.
4. The temperature of the concrete will be determined by placement of thermometers on the concrete surfaces and properly insulating these devices to record the surface temperature of the concrete according to NV Test Method T440.
 - a. Temperature will be monitored continuously throughout the total projection time required by this subsection.
 - b. If the surface temperature of the concrete falls below 50 degrees F during the first 3 days and 40 degrees F during the next 4 days of the temperature protection for a duration of 3 hours, the curing time will be increased 1 day for each day this occurs.
 - c. Should the temperature of the concrete fall below 35 degrees F at any time during the 7 days of temperature protection or if the surface temperature of the concrete falls below 40 degrees F during the first 24 hours of temperature protection period, the assessment of damage will be determined by a Nevada registered professional engineer paid for by the Contractor and damaged concrete shall be repaired or replaced at the option of the Engineer.
 - d. Contractor shall be responsible for all costs associated with damage assessment and repair.
- D. **Hot Weather.** Comply with guidelines in ACI 305, Hot Weather Concreting, with the following exceptions or additions:
 1. The maximum temperature of cast-in-place concrete shall not exceed 90 degrees F immediately before placement.

2. For continuous placement of concrete on the deck with reinforcing steel units, retard the initial set of the concrete sufficiently to ensure that concrete remains plastic for subsequent placement.
3. For both simple and continuous spans, submit a retardation schedule for approval.
4. The consistency of the concrete as placed shall allow the completion of initial finishing operations without the addition of water to the surface. When conditions are such that additional moisture is needed for initial finishing, the required water shall be applied to the surface fog spray only, and shall be held to a minimum amount. Apply fog spray for this purpose as specified in **Subsection 501.03.09.A.2, "Water Method."** Fog spray for this purpose may be applied with hand-operated fog equipment, as approved by the Engineer.
5. From the time of initial strike-off until final finish is complete, the unformed surfaces of slab concrete shall be protected from rapid evaporation of mixing water from the concrete due to wind, high temperature, low humidity, or combination thereof.
6. Equipment for fogging, type of evaporation retarder, and method of application shall be approved by the Engineer. Equipment shall be portable, adapted for intermittent use, and operable in the direction of any prevailing wind.
7. Use fogging equipment capable of providing a fog mist, as necessary, to the area between the finishing machine and the tining machine. The fogging equipment shall meet the requirements of **Subsection 501.03.09.A.2, "Water Method."** If at any time it becomes apparent that the combination of fogging and curing application are not, or will not be effective in preventing plastic shrinkage cracking, stop the concrete placement until environmental conditions improve substantially, or until other preventative measures are approved in writing by the Engineer.
8. After all finishing operations are complete a final curing membrane shall be applied.

501.03.11 TRIAL SLAB AND PROCESS CONTROL TESTING

- A. If silica fume is used in bridge deck concrete, construct a trial slab at least 30 days prior to placement of concrete on a bridge deck. Submit a written plan for the casting of decks. Include in this plan, at a minimum, the location of slab, the equipment and personnel used for construction, and disposal of slab. Prior to placement of the trial slab, conduct a Pre-Activity Meeting.
- B. Use approved mix designs. Place concrete at a location other than the bridge deck, but under similar conditions to those that exist during bridge deck concrete placement.
 1. The trial slab shall have a minimum length and width of 50 feet and a depth of 8 inches.
 2. Reinforce slab with a top and bottom mat of No. 5 bars spaced 6 inches longitudinally and transversely.
 3. Place top mat at a depth of 2-1/2 inches from the top of the slab.
 4. Place bottom mat at a depth 1-1/2 inches from the bottom of slab.
 5. The trial slab shall be wet-cured in accordance with the specifications.
 6. Use personnel such as superintendent, key operators, and finishers that are the same personnel who will be involved in the final construction of the bridge deck.
 7. Demonstrate the use of equipment, proficiency of personnel, and techniques for mixing, transporting, placing, and curing of the concrete during the trial.

8. Fifteen days after the placement of the trial slabs, conduct a post construction critique of the trial slab placement in writing.
- C. Do not commence placement of bridge deck concrete until after any issues from the post construction critique of trial slab construction have been resolved to satisfaction of the Engineer.
- D. Upon notification, remove and dispose of trial slabs according to **Subsection [107.14](#), "Disposal of Material Outside Project Right-of-Way."**

501.03.12 MORTAR

- A. Cement mortar shall consist of a mixture of Portland cement, sand, and water. Cement and sand shall first be combined in the proper proportions, and then thoroughly mixed with the required amount of water.

1. Cement mortar shall be designated by class and proportioned by loose volume as follows:

Table 3 - Mortar Proportioning	
Designation	Proportions
Class "A" Mortar	1 Part Cement to 1 Part Sand
Class "B" Mortar	1 Part Cement to 1-1/2 Parts Sand
Class "C" Mortar	1 Part Cement to 2 Parts Sand
Class "D" Mortar	1 Part Cement to 2-1/2 Parts Sand
Class "E" Mortar	1 Part Cement to 3 Parts Sand
Class "F" Mortar	1 Part Cement to 3-1/2 Parts Sand

2. The quantity of water to be used in the preparation of mortar shall be only that required to produce a mixture sufficiently workable for the purpose intended.
3. Mortar shall be used as soon as possible after mixing and shall show no visible signs of setting prior to use. Re-tempering of mortar will not be permitted.
- B. **Cement.** Cement shall conform to the requirements of **Section [701](#), "Hydraulic Cement."**
- C. **Sand.** Sand shall conform to the requirements of **Subsection [706.03.04](#), "Grout and Mortar Sand."** In proportioning the sand it shall be measured loose (without shaking or compacting) in measuring boxes or other suitable containers of known capacity.
- D. **Admixtures.** No admixture shall be used in mortar unless otherwise specified or approved by the Engineer.

04METHOD OF MEASUREMENT

501.04.01 MEASUREMENT

- A. Portland cement concrete will be measured for payment in accordance with the provisions specified in the various sections of these specifications covering construction requiring concrete.

05BASIS OF PAYMENT

501.05.01 PAYMENT

- A. Portland cement concrete shall be paid for in accordance with the provisions specified in the various sections of these specifications covering construction requiring concrete.

501.05.02 TRIAL SLAB PAYMENT

- A. Full compensation for construction and removal of trial slabs and trial pours shall be considered as included in the contract unit price paid for other appropriate items and no separate payment will be made therefor.

SECTION 704

BASE AGGREGATES

SCOPE

704.01.01 MATERIALS COVERED

- A. This specification covers the quality and size of mineral materials used in base courses, trench backfill, or other construction locations.
- B. The term Source shall mean any of the following:
 - 1. A permanent commercial location.
 - 2. Contractor manufactured material either commercial or on-site.

704.01.02 REFERENCE CODES AND STANDARDS:

- A. Related Interagency Quality Assurance Committee (IQAC) procedures at:
http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx
 (IQAC website)

REQUIREMENTS

704.02.01 GENERAL

- A. The mineral aggregate shall be the crushed and screened product from approved aggregate deposits, except that Type I aggregate base need not be crushed. The Engineer reserves the right to prohibit the use of aggregates from any source when:
 - 1. The character of the material is such, in the opinion of the Engineer, as to make improbable the furnishing of aggregates conforming to the requirements of these specifications.
 - 2. The character of the material is such, in the opinion of the Engineer, that undue additional costs may be accrued by the Contracting Agency.
- B. The mineral aggregate shall be clean, hard, durable, free from any frozen lumps, deleterious matter, and harmful adherent coatings. Crushed Portland cement concrete and asphaltic concrete pavement will be permitted, subject to the requirements of these specifications. No materials subject to regulation as hazardous wastes as defined in the Nevada Administrative Code 444.8565 shall be allowed.

704.02.02 IQAC SOURCE QUALIFICATION

- A. For expediting of material source and type approvals, a listing of qualified materials has been provided on the IQAC website.
- B. Any listed material is considered qualified for use without a material testing submittal. However, this does not relieve the Contractor of project testing of the material as required in these specifications.
- C. The IQAC posted materials indicated in Table 1 are subject to reapproval ~~annually~~ annually for continued posting on the IQAC website. The procedure is annotated in **Subsection 704.04.02, "IQAC Annual Material Prequalification."**

Table 1 – IQAC Materials that Require Annual Qualification

Type II Aggregate Base
Type II Controlled Low Strength Material (CLSM)

Table 2 – Materials that Require 6-Month Qualification

Type II blended with recycled Portland Cement Concrete
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704.02.03 DEFICIENCIES

- A. If the product of a deposit is deficient in material passing the No. 16 sieve, filler from other approved deposits may be added at the crushing and screening plants. This is not to be construed as a waiver of any of the requirements contained herein.

03PHYSICAL PROPERTIES AND TESTS**704.03.01 PLASTIC LIMITS**

- A. When specified, aggregates shall conform to the applicable requirements of the following table:

Table 3 – Plastic Limits

Percentage by Weight Passing 200 Sieve	Plasticity Index Maximum
0.1 to 3.0	15
3.1 to 4.0	12
4.1 to 5.0	9
5.1 to 8.0	6
8.1 to 11.0	4
11.1 to 15.0	3

704.03.02 DRAIN BACKFILL

- A. This aggregate shall conform to the following requirements:

Table 4 – Drain Rock Gradation Acceptance Limits

Sieve Sizes	Percentage by Dry Weight Passing Sieve		
	3-Inch Size	2-Inch Size	3/4-Inch Size
3-Inch	100	--	--
2-Inch	90-100	100	--
1-1/2-Inch	70-100	95-100	--
3/4-Inch	0-50	50-100	100
1/2-Inch	--	--	95-100
3/8-Inch	0-10	0-55	70-100
No. 4	--	0-25	0-70
No. 8	0-5	0-15	--
No. 200	0-3	0-3	0-3

- B. Unless otherwise specified in the contract documents, the Contractor may use any of the sizes.

Table 5 – Drain Backfill Durability Acceptance Limits

Source Requirement Test	3-Inch Size	2-Inch Size	3/4-Inch Size
Percentage of Wear (500 Rev.)	45% Maximum	45% Maximum	45% Maximum

704.03.03 TYPE I AGGREGATE BASE

A. This aggregate shall conform to the following requirements:

Table 6 – Type I Gradation Acceptance Limits

Sieve Sizes	Percentage by Dry Weight Passing Sieve	
	3-Inch Size	2-Inch Size
3-Inch	100	--
2-Inch	90-100	100
1-1/2-Inch	--	95-100
1-Inch	--	70-90
No. 4	30-65	30-65
No. 16	15-40	15-40
No. 200	2-12	2-12

Table 7 – Type I Acceptance Limits

Project Control Test	Test Method	Requirements
Sieve Analysis	AASHTO T27	Table 6
Sampling Aggregate from Calibrated Conveyor stream or belt cut ¹	AASHTO T2	--
Plasticity Index	AASHTO T90 ²	Table 3
Liquid Limit	AASHTO T89	35 Maximum
Resistance (R Value)	ASTM D2844	60 Minimum
Percentage of Wear (500 Rev.)	AASHTO T96	45% Maximum

704.03.04 TYPE II AGGREGATE BASE

A. This aggregate shall conform to the following requirements:

Table 8 – Type II Gradation Acceptance Limits

Sieve Sizes	Percentage by Dry Weight Passing Sieve
1-Inch	100
3/4-Inch	90-100
No. 4	35-65
No. 16	15-40
No. 200	2-10

¹ Sampling from a stockpile permitted only after approval of the Engineer; the conveyor device shall be calibrated every 3 months and record attached to sample document.

² Test specimens shall be prepared following the dry preparation procedure AASHTO T87.

Table 9 – Type II Acceptance Limits

Quality Control Test	Test Method	Requirements
Sieve Analysis	AASHTO T27	Table 8
Sampling Aggregate from Calibrated Conveyor stream or belt cut ³	AASHTO T2	--
Fractured Faces	Nev. T230	70% Minimum
Plasticity Index	AASHTO T90 ⁴	Table 3
Liquid Limit	AASHTO T89	35 Maximum
Resistance (R Value) or Resilient Modulus	ASTM D2844 AASHTO T307	78 Minimum for road base 35,000 psi minimum for road base
Percentage of Wear (500 Rev.)	AASHTO T96	45% Maximum
Total Available Water Soluble Sulfates ⁵	ASTM D2791 AWWA 4550 E	Less than 0.3% by dry weight of soil.

- B. Type II Plantmix Aggregate as specified in **Subsection 705.03.01, "Plantmix and Roadmix Bituminous Base and Surface Aggregate, Types Two Fine and Coarse and Three,"** may be used in lieu of Type II Base Aggregate as specified above.

704.03.05 TYPE III AGGREGATE

- A. The soluble sulfate content shall not exceed 0.3 percent by dry weight of soil. The mineral shall be clean, hard, durable, free from any frozen lumps, deleterious matter, and harmful coatings. In addition thereto, the material shall conform to the gradation requirements of Type II aggregate base in accordance with **Subsection 704.03.04, "Type II Aggregate Base,"** with the following property testing:

Table 10 – Type III Acceptance Limits

Quality Control Test	Test Method	Requirements
Sieve Analysis	AASHTO T27	Table 8
Sampling Aggregate from Calibrated Conveyor stream of belt cut ⁶	AASHTO T2	--
Plasticity Index	AASHTO T 90 ⁷	Table 3
Liquid Limit	AASHTO T 89	35 Maximum
No. 200 Sieve	AASHTO T 27	2-15%
Total Available Water Soluble Sulfates ⁸	AWWA 3500-NaD AWWA 4550 E	Less than 0.3% by dry weight of soil

704.03.06 CRUSHED ROCK

- A. Crushed rock shall be the product from approved aggregate deposits and shall only be used as directed by the Contracting Agency. The mineral aggregate shall be clean, hard,

³ Sampling from a stockpile permitted only after approval of the Engineer; the conveyor device shall be calibrated every 3 months and record attached to sample document.

⁴ Test specimens shall be prepared following the dry preparation procedure AASHTO T87.

⁵ Required only for placement around waterline pipe.

⁶ Sampling from a stockpile permitted only after approval of the Engineer.

⁷ Test specimens shall be prepared following the dry preparation procedure AASHTO T87.

⁸ Required only for placement around waterline pipe.

durable, free from any frozen lumps, deleterious matter, and harmful coatings. In addition thereto, the material shall conform to the following gradation requirements:

Table 11 – Crushed Rock Gradation Acceptance Limits

Sieve Sizes	Percentage of Weight Passing
3/8-Inch	100
No. 4	20-80
No. 200	0-15

Table 12 – Crushed Rock Acceptance Limits

Quality Control Test	Test Method	Requirements
Sieve Analysis	AASHTO T 27	Table 11
Sampling Aggregate From Calibrated Conveyor stream of belt cut ⁹	AASHTO T 2	-----
Fractured Faces	Nev. T 230	90% Minimum
Plasticity Index	AASHTO T 90 ¹⁰	Table 3
Liquid Limit	AASHTO T 89	35 Maximum
Percentage of Wear (500 Rev.)	AASHTO T 96	45% Maximum
Total Available Water Soluble Sulfates ¹¹	AWWA 3500-NaD AWWA 4550 E	Less than 0.3% by dry weight of soil

704.03.07 CONTROLLED LOW STRENGTH MATERIAL (CLSM)

- A. CLSM shall consist of a low-strength, self-leveling concrete material composed of various combinations of cement, fly ash, aggregate, water, and chemical admixtures. CLSM shall have a design compressive strength at an age of 28 days within the ranges required below for the specified class:
- Class I - (~~50-20~~ to 150 psi): Specified where the maximum strength is of primary concern due to the desire to have material that can be excavated in the future with relative ease.
 - Class II – (100 to 300 psi): Specified where the minimum strength is of primary concern for pipe support.
 - Class Special (as shown in project specifications or drawings): Specified where project unique criteria, such as erosion control, are the primary concern.
 - Class I and Class II CLSM:
 - The mix shall result in a product having a slump in the range of 6 to 10 inches at the time of placement in the pipe zone. Above the pipe zone, a lesser slump is acceptable.
 - The Source of Contractor shall submit a mix design for approval by the Engineer prior to placement.

⁹ Sampling from a stockpile permitted only after approval of the Engineer; the conveyor device shall be calibrated every 3 months and record attached to sample document.

¹⁰ Test specimens shall be prepared following the dry preparation procedure AASHTO T87.

¹¹ Required only for placement around waterline pipe.

- c. The mix design shall be supported by laboratory test data verifying the potential of the mix to comply with the requirements for these specifications.
- e-5. Class III – Bonded Aggregate Fill (BAF) (20 to 150 psi): Specified where the maximum strength is of primary concern due to the desire to have material that can be excavated in the future with relative ease, and where reduced concrete cure time is desired.
- B. CLSM Class I and Class II shall be proportioned in general compliance with the methods outlined in ACI 211.1-91, ~~reapproved 1997~~, "Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete." The product shall be proportioned and mixed in a central plant or mobile mixer. The following materials shall be used:
1. Cement shall meet the requirements of **Section 701, "Hydraulic Cement."** Type V cement shall be used unless otherwise specified.
 2. Fly ash shall meet the requirements of **Section 729, "Fly Ash."** Fly ash not meeting the requirements of **Section 729, "Fly Ash,"** may be used if prior testing indicates to the satisfaction of the Engineer the ability of the CLSM with this fly ash to meet these specifications.
 3. Water shall meet the requirements of **Section 722, "Water."**
 4. Aggregates shall be well graded, have having 100 percent by total weight ~~of the aggregate~~ passing the 1 inch screen and no less than 6-15 percent ~~or less~~ passing the No. 200 sieve. The aggregate shall meet the plastic limits requirements of **Subsection 704.03.01, "Plastic Limits."**
 5. Chemical admixtures shall meet the requirements of **Subsection 702.03.02, "Air-Entraining Admixtures,"** and **Subsection 702.03.03, "Admixtures Other Than Air-Entraining."**
 - a. Other admixtures specifically approved for CLSM may be used.
 - b. All materials proportions shall be measured and the CLSM mixed in accordance with **Section 501, "Portland Cement Concrete."**
 - c. Other proportion measuring and CLSM mixing systems are acceptable, if control can be demonstrated to be satisfactory to the Engineer.
 - d. These other methods include continuous feed, volumetric measurement of proportions, and pug mill and continuous mixing plants.
- C. If the CLSM Class I and Class II mixes ~~does~~ not produce a flowable consistency or exhibits excessive bleeding, the mix shall be adjusted.
1. Excessive bleeding is considered to occur when water flows from the CLSM in a manner that causes disturbance or displacement of the exposed surface of the CLSM.
 2. Mix adjustments shall include, but not be limited to: aggregate gradation, cementitious material content, admixtures, water content, or a combination of adjustments.
- D. The testing procedures ~~for approval~~ of CLSM Class I and Class II for acceptance testing and mix designs—design approval by the IQAC, or if required in the contract special provisions shall be as follows:
1. The material Source, which may be the Contractor, shall cast ~~one set of six each 4-inch diameter by 8-inch high specimens in split cylinders~~ specimen molds using

ASTM D4832 "Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM Test Cylinders)." The type of molds shall be as stated below.

a. Section 6.1 other sizes and type

1) Grout Sample Box must meet ASTM C1019, Note 6 and the following:

a) A Grout Sample Box that has a minimum absorption rate of 1.30% or that both the QA and QC laboratories have the same absorption with a tolerance of 0.2.

b) Creates four specimens with nominal dimension of 3"x3"x6".

1-2) The QA and QC must agree in a pre-activity meeting which vendor of grout sample box will be used for the casting mold to comply with Note 6 in ASTM C1019 for proper comparisons.

2. No rodding method shall be used for the placement of the CLSM into the cylinders. Sampling shall be in accordance with ASTM D4832.

3.2. All field curing and environmental protection shall conform to AASHTO T23, "Test Methods for Making and Curing Concrete Test Specimens in the Field."

4.3. The cast specimens shall ~~then not~~ be laboratory-cured in a ~~100 percent humidity, temperature controlled~~ concrete cure room (cure tanks shall not be used). The samples must be cured at the ambient temperature of the laboratory at a range between 65° and 85° degrees F.

5.4. Compressive strength testing shall be performed in accordance with AASHTO T22 and T23 with samples from each set at the ages of ~~714, and 28, and 90~~ days.

6.5. A report of the results shall be submitted to the Engineer.

E. Class Special: The compressive strength testing procedures shall be as specified in the project specifications or on the project drawings.

F. **Class III - Bonded Aggregate Fill (BAF):**

1. This material is a crushed rock-cement slurry consistency.

2. BAF may be used only with the prior approval of the Engineer.

3.1. The material Source shall have it designed under the responsible charge of a Nevada PE, and the mix shall consist of a gap-graded 1/2-inch maximum nominal size crushed gravel. The cementitious material shall be with a 1-sack minimum Type V cement and/or fly ash and water for a slurry flowable type consistency.

4.2. The material shall be plant mixed and placed from a truck or may be placed directly from a continuous feed mobile mixer approved by the Engineer.

5.3. Due to the gap-graded nature of the material, it shall not be used where water drainage is an issue unless wrapped in an approved geotechnical filter fabric, and in all ~~cases~~ trench installations shall ~~use dams as specified in~~ conform to Subsection 208.03.16, "Drain Backfill."

6.4. This ~~procedure material~~ does not require concrete cylinder break testing; however, it does require a visual inspection and shall be documented in a report to the Engineer summarizing the inspection to be performed as follows:

- a. After the first batch is placed and initially cured, excavate to the bottom of the pipe or structure.
- b. If a self-supporting vertical face is maintained, the material is functioning properly.

704.03.08 AGGREGATE FOR PORTLAND CEMENT TREATED BASE

- A. This aggregate shall conform to the following requirements:

**Table 13 – Portland Cement Treated Base Gradation
Acceptance Limits**

Sieve Sizes	Percentage by Dry Weight Passing Sieve
3-Inch	100
2-Inch	90-100
No. 4	35-75
No. 200	20

Table 14 – Portland Cement Treated Base Acceptance Limits

Test	Test Method	Requirements
Sieve Analysis	AASHTO T27	Table 13
Sampling Aggregate from Calibrated Conveyor stream or belt cut ¹²	AASHTO T2	1/1000 Tons per day or portion thereof
Percentage of Wear (500 Rev.)	AASHTO T96	45% Maximum

- B. Aggregate for cement or lime treated bases will be sampled as follows:
1. Where the material is being mixed at a stationary plant, samples will be taken from the conveyors just prior to delivery to the mixer and prior to adding lime or cement.
 2. Where material is being mixed on the roadbed, samples will be taken after the material has been placed on the roadbed and processed and prior to adding cement or lime.

704.03.09 SHOULDERING MATERIAL

- A. This aggregate shall conform to the following requirements:

Table 15 – Shouldering Material Acceptance Limits

Sieve Sizes	Percentage by Dry Weight Passing Sieve
1-Inch	100
3/4-Inch	90-100
No. 4	35-65
No. 16	15-40
No. 200	2-6

704.03.10 AGGREGATE BASE MATERIAL WITH RECYCLED ASPHALT PAVEMENT (RAP) AND CONCRETE

- A. The use of recycled asphalt pavement or recycled concrete for Type II Aggregate Base is permitted with the following requirements:

¹² Sampling from a stockpile permitted only after approval of the Engineer. The conveyor device shall be calibrated every 3 months and record attached to sample document.

1. The material must conform to the requirements of **Subsection 704.03.04 "Type II Aggregate Base."**
 2. The maximum ratio of crushed concrete to Type II Aggregate Base is 50%. Recycled materials must be substantially free of foreign matter including but not limited to asphalt, base, dirt, reinforcing steel, and have at most 1.5% deleterious material.
 3. The maximum ratio of the crushed recycled asphalt concrete pavement (RAP) to Type II Aggregate Base is 30%. The mean oil content shall be 1.2% with a +0.3% tolerance. The Total Oil Content of the blended material (virgin aggregate and RAP) shall not exceed 1.5%.
- B. The maximum qualification period is six (6) months for aggregate base materials blended with recycled aggregates. The entire qualification process must be completed prior to the first day of April and the first day of October of each calendar year. The report format, as outlined in **Subsection 704.04.05 "Report Format"** shall include the sieve analysis for RAP or recycled concrete stockpile, Blended aggregate, the RAP binder content and blended binder content.

04SOURCE QUALITY CONTROL TESTING

704.04.01 GENERAL

- A. There are 2 testing aspects to Source material acceptance.
1. Testing by the Source for annual posting on the IQAC website of qualified materials.
 2. Contractor project quality control Source testing for non-qualified materials.
- B. The acceptance of the Source material shall be at the production plant while the acceptance of the Contractor-placed material is at the project site.
- C. Any laboratory submitting to an agency shall be R-18 AASHTO accredited in the appropriate test method in accordance with Table 16, "Source Quality Control Testing Requirements," where applicable and testing reviewed and stamped by a Nevada professional engineer who has responsible charge of the work. The use of a professional engineer by the Source could be the Source staff engineer or third party, but the professional engineer must have responsible charge of the testing and/or inspection.

704.04.02 IQAC ANNUAL MATERIAL PREQUALIFICATION

- A. Each individual location or "pit" shall be referred to as a "Source." The responsibility for testing and inspection is the material Source. Material shall be tested, inspected, and certified in accordance with Table 16 "Source Quality Control Testing Requirements." The Source shall submit to the IQAC agency engineer assigned for that Source. The reviewing agency is listed on the IQAC website page next to the Source material.
- B. Test data shall be included with the certifying document.
- C. The maximum qualification period is 1 year, or 6 months for aggregate blended with crushed concrete. The entire qualification process shall be completed, in accordance with the sections above, prior to the first day of April, or for aggregates blended with crushed concrete, the first day of April and the first day of October of each year. This includes, but is not limited to, submittal, agency review, all required retesting, and qualification from the IQAC member.

704.04.03 NON-PREQUALIFIED MATERIALS

- A. If the material is not posted on the IQAC web page, the Source may elect to submit non-prequalified material to the Engineer for approval prior to use that complies with the above noted specification and shall have been tested within 60 days of the intended use.

704.04.04 SUBMITTAL

- A. All tests specified in this section shall be performed.
1. The report(s) shall include any graphical representation of plotted data such as the R-value or the Proctor value(s) along with the pit name and location.
 2. The most current ASTM, AASHTO, NDOT, and AWWA methods shall be used when performing the tests.
- B. All samples shall be "cut" from the "belt." When circumstances do not allow for sampling during production, the Source shall coordinate with the Engineer to identify an alternative plan for sampling.
- C. IQAC Annual Submittal
1. For the purposes of IQAC submittal, the Engineer is the IQAC reviewing agency as noted on the IQAC web page.
 2. For the annual submittal by the supplier, the material to be approved for use as aggregate shall be obtained and "split" by an AASHTO accredited laboratory with the Engineer present at the time the sample is obtained with the sample large enough for a full suite of testing for the Source and Engineer.
 3. The Engineer shall be notified a minimum of 48 hours prior to obtaining the sample.
 4. If the Engineer is not present during the sampling of the material, the results for that sample will not be accepted.
 5. Sampling shall be performed during normal working hours for the Engineer.
 6. If the Source laboratory results are in compliance with the above noted specifications, Source shall submit the test report to the Engineer within 21 days of sampling requesting the review and approval of the materials for the proposed use of the material.
 7. Notification by the Source of samples not in compliance with the above noted specifications is requested but not required. Samples without notification or a qualification submittal within the 21-day period will be assumed by the IQAC to be outside the above noted specifications.
 8. The agency Engineer for a particular pit may accommodate minor adjustments for "tuning" of an operation. This courtesy shall not be extended during the qualification process.
- D. Non-prequalified materials (materials not posted on the IQAC list)
1. The material to be approved for use as aggregate shall be obtained and "split" by an AASHTO accredited laboratory with the Engineer present at the time the sample is obtained with the sample large enough for a full suite of testing for the Source and Engineer.
 - a. The Engineer shall be notified a minimum of 48 hours prior to obtaining the sample.

- b. If the Engineer is not present during the sampling of the material, the results for that sample will not be accepted.
 - c. Sampling shall be performed during normal working hours for the Engineer.
 - d. If the Source laboratory results are in compliance with the above noted specifications, the Source shall submit the test report to the Engineer within 21 days of sampling with a letter requesting the review and approval of the materials report for the proposed use of the material.
2. Notification by the Source of samples not in compliance with the above noted specifications is requested but not required.
 - a. Samples without notification or a qualification submittal within the 21-day period will be assumed by the IQAC to be outside the above noted specifications.
 - b. The Source shall submit the material test report to the Engineer no earlier than 60 days and no later than 14 days prior to use.
3. The qualification is for one project only.

704.04.05 REPORT FORMAT

- A. The report shall be prepared and stamped by, or under the direction of, a professional engineer registered in the state of Nevada. The report shall be on the standard IQAC¹³ form and shall include the pit name and location. The report shall include the following:
 1. Recommendation by the Source Professional Engineer.
 2. The testing results in accordance with the appropriate Table 16, "Source Quality Control Testing Requirements," test methods and reporting requirements, along with any graphs and charts.
- B. When "no exceptions" are taken, a conditional posting on the web site will be provided by the IQAC within 10 days of the receipt of the submittal.
- C. Discrepancies between test results will be reviewed on a case-by-case basis. The Engineer will notify the aggregate producer of substantial test variations within 10 days of receipt of the qualification submittal.

704.04.06 SAMPLING AND TESTING

- A. When the Contractor/Material Source or Engineer acquires aggregate samples at an aggregate production plant, the plant shall provide a calibrated mechanical means for obtaining samples.
 1. If a mechanical means is not provided, a belt cut from a stopped conveyor will be required.
 2. Any mechanical sampling device shall be approved by the Engineer prior to starting the respective phase of the project, or shall have been approved as part of a prior plant inspection by the Engineer or the Engineer's representative.
 3. The sampling device shall be so constructed to provide for simultaneous "cutting" of the entire section of material being discharged or conveyed, and so constructed that

¹³ The form is on the IQAC website, or use an Agency approved form.

small representative samples may be taken frequently and these samples combined to form the complete sample.

4. The reference method for the mechanical procedure shall be a "belt cut" sample taken from a stopped conveyor belt.
 5. Samples of the finished product of the plant shall be obtained prior to or as the material leaves the conveyor belt for the bin or stockpile.
- B. Test results run from samples taken will be furnished to the Engineer by the Contractor or the Contractor's representative. The results of such tests shall not be the basis for final acceptance of the material.
- C. Sampling for final acceptance of materials will be as required in the appropriate USS sections and in general shall comply with the AASHTO requirements, where applicable, and with any exception to the method(s) listed on the IQAC website.

Table 16 – Source Quality Control Testing Requirements¹⁴

Spec Section	Description	Item	Reference Specification and/or Test Procedure	Frequency
704.03.02 , 704.03.03 , 704.03.04 , 704.03.08	Drain Rock	Submittal	IQAC and/or Agency Requirements	Annually for IQAC Source Approval OR per project
	Type I, Type II Aggregate	Sampling from calibrated conveyor stream or belt cut	AASHTO T2	1/day at plant
	Cement treated base	Sieve Analysis	AASHTO T11 & T27	1/day at plant
		Percentage of Wear (500 Rev.)	AASHTO T96	Annually for Source Approval OR per project
704.03.04 , 704.03.05 , 704.03.06	Drain rock, Type II, and Type III aggregate around water pipe	Total Available Water Soluble Sulfates ¹⁵	AWWA 3500-NaD AWWA 4550 E	1/month at plant
704.03.03 , 704.03.04	Type I and Type II Aggregate	Plasticity Index	AASHTO T90 ¹⁶	1/day at plant
		Liquid Limit	AASHTO T89	1/day at plant
		Resistance (R Value) or Resilient Modulus	ASTM D2844	Annually for IQAC Source Qualification OR per project
			AASHTO T307	Annually for IQAC Source Qualification OR per project
704.03.07	CLSM <u>Class I & II</u>	Mix Design	USS 704.03.07	Annually for IQAC Source Qualification OR per project
		Compressive Strength	USS 208.02.07 & AASHTO T22, T23	Annually for IQAC Source Qualification OR per project
	CLSM <u>Class III</u> -BAF	Visual Inspection Report	USS 208.02.07 Split cylinders	Annually for IQAC Source Qualification OR per project

¹⁴ Review the IQAC website for any exceptions to the listed test methods.

¹⁵ Required only for placement around waterline pipe.

¹⁶ Test specimens shall be prepared following the dry preparation procedure AASHTO T87.

SECTION 706

AGGREGATES FOR PORTLAND CEMENT PRODUCTS

01SCOPE

706.01.01 MATERIALS COVERED

- A. This specification covers the quality and size of aggregates used in Portland cement products.

02REQUIREMENTS

706.02.01 GENERAL

- A. The mineral aggregate shall be the product of approved deposits. The Engineer reserves the right to prohibit the use of aggregates from any source when:
1. The character of the material is such, in the opinion of the Engineer, as to make improbable the furnishing of aggregates conforming to the requirements of these specifications.
 2. The character of the material is such that, in the opinion of the Engineer, undue additional costs may be accrued by the Contracting Agency.
 3. The mobile mixer shall use aggregate from an approved source. Each mixer shall not change source product without a new mix design. The certificate of the source shall include the appropriate test data.
 - 2.4. The testing type and frequency shall conform to the tables on the Clark County IQAC website page:
http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx
- B. For mix design approval, the proposed proportions of coarse, intermediate, and fine aggregate, combined mathematically by volume or mass, shall produce a mixture within the grading limits for combined aggregates as shown in Table 1 (not applicable to lightweight concrete):

Table 1 - Grading Limits of Combined Aggregates

Sieve Size	Percentage Passing				
	1-1/2-inch Max.	1-inch Max	3/4-inch Max.	1/2-inch Max	3/8-inch Max.
2-inch	100	--	--	-	-
1-1/2-inch	87-100	100	--	-	-
1-inch	65-90	97-100	100	-	-
3/4-inch	48-82	70-100	80-100	100	-
1/2-inch	--	--	--	90-100	100
3/8-inch	39-57	43-70	46-70	70-90	70-100
No. 4	30-45	32-48	34-50	45-60	47-70
No. 8	23-38	23-42	24-42	38-56	34-55
No. 16	15-33	15-34	17-34	24-38	23-43
No. 30	8-24	8-25	10-25	13-27	15-33
No. 50	4-13	4-15	5-15	7-17	7-20

Table 1 - Grading Limits of Combined Aggregates

Sieve Size	Percentage Passing				
	1-1/2-inch Max.	1-inch Max	3/4-inch Max.	1/2-inch Max	3/8-inch Max.
No. 100	1-5	2-7	2-7	0-6	2-8
No. 200	0-5	0-5	0-5	0-5	0-5

- C. If the Contractor prefers a finer gradation for the purpose of slip-form operations, the following gradation is permitted with approval of the Engineer.

Table 2 - Gradation for Slip-Form Operations

Sieve Size	Percentage Passing	
	1-1/2-inch Max.	3/4-inch Max.
2-inch	100	--
1 1/2-inch	87-100	--
1-inch	65-97	100
3/4-inch	48-91	80-100
1/2-inch	--	--
3/8-inch	39-70	46-74
No. 4	30-54	34-54
No. 8	23-38	24-50
No. 16	15-33	17-38
No. 30	8-24	10-29
No. 50	4-13	5-19
No. 100	1-5	2-9
No. 200	0-5	0-5

- D. If the Contractor proposes to use an admixture other than an air-entraining agent, Contractor shall state the complete brand name and the quantity proposed to be used per sack of cement.
- E. Should the Contractor change Contractor's source of supply, Contractor shall submit in writing to the Engineer the new gradation before their intended use.
- F. In addition to the coarse, intermediate, and fine aggregates meeting the individual source requirements, the combined gradation shall meet the following source requirement:

Table 3 - Alkali-Silica Reaction

Source Requirement Test, Combined Aggregates	Test Method	Requirement
Accelerated Detection of Potentially Deleterious Expansion of Mortar Bars Due to Alkali-Silica Reaction	AASHTO T303	0.10% Max. Expansion ¹

- G. Previous AASHTO T303 qualified aggregates for concrete mix designs will not automatically qualify for approval. Submit new AASHTO T303 test results with concrete mix design.
- H. Perform this test on the coarse, intermediate, and fine aggregates together, combined in the same proportions as the proposed mix design.

¹ This requirement applies to all aggregate used in the concrete bridge structures, including approach slabs, reinforced concrete boxes, walkways, or sidewalks on the bridge structure itself, and all concrete bridge rail.

1. The test may be performed on each size separately and the results combined mathematically.
 2. Perform the test using the proposed sources together with proposed job cement and job pozzolan or other admixture, if used.
 3. The pozzolan and silica fume quantities will be considered as cement in meeting the requirements of cement in Table 2 of **Subsection 501.03.04, "Classification and Proportions."**
- I. Prior to mix design approval, the Contracting Agency reserves the right to verify the AASHTO T303 test results, using the sources and proportions of materials as indicated by the mix design.
- J. Conduct another test upon changes in source of cementitious materials, including fly ash, or changes in cement type or mitigating admixture suppliers.

03PHYSICAL PROPERTIES AND TESTS

706.03.01 COARSE AGGREGATE

- A. The aggregate shall conform to the following table requirements:

Table 4 - Percentage by Weight Passing Sieve

Sieve Size	Size No. 3 2-inch to 1-inch	Size No. 4 1-1/2-inch to 3/4-inch	Size No. 7 1/2-inch to No. 4	Size No. 57 1-inch to No. 4	Size No. 67 3/4-inch to No. 4	Size No. 357 2-inch to No. 4	Size No. 467 1-1/2-inch to No. 4
2-1/2-inch	100	--	--	--	--	100	--
2-inch	95-100	100	--	--	--	95-100	100
1-1/2-inch	35-70	90-100	--	100	--	--	95-100
1-inch	0-15	20-55	--	95-100	100	35-70	--
3/4-inch	--	0-15	100	--	90-100	--	35-70
1/2-inch	0-5	--	90-100	25-60	--	10-30	--
3/8-inch	--	0-5	40-70	--	20-55	--	10-30
No. 4	--	--	0-15*	0-10*	0-10*	0-5	0-5

*Not more than 5 percent shall pass No. 8 Sieve.

NOTE: Sizes No. 357 and No. 467 shall each be split into 2 sizes. Size No. 357 shall be furnished in stockpile or bunker in Sizes No. 3 (2-inch to 1-inch) and Size No. 57 (1-inch to No. 4.) Size No. 467 shall be furnished in stockpile or bunker in Size No. 4 (1-1/2-inch to 3/4-inch) and Size No. 67 (3/4-inch to No. 4). The two sizes shall be uniformly combined at the mixing plant to comply with the grading requirements of Sizes No. 357 and No. 467 respectively.

Table 5 - Coarse Aggregate Properties

Tests	Test Method	Requirements
Sieve Analysis	AASHTO T27	Above
Sampling Aggregate	ASTM D75	--
Material Passing 200 Sieve	AASHTO T27	1% Maximum
Percentage of Wear (100 Rev.)	ASTM C131	10% Maximum
Percentage of Wear (500 Rev.)	ASTM C131	50% Maximum
Soundness (5 Alternations) (sodium sulfate)	AASHTO T104	9% Maximum Loss

Table 5 - Coarse Aggregate Properties

Tests	Test Method	Requirements
Cleanliness Value min.	CALIF 227	71 706.03.01.B.1
Clay Lumps	AASHTO T112	1% Maximum
Potential Reactivity	AASHTO T303	Innocuous 706.03.01.B.2

- B. Thin or elongated pieces (length greater than 5 times maximum thickness) shall not exceed 15 percent by weight.
- When 2 or more stockpiles are to be combined, each stockpile shall have a cleanliness value of at least 65 with a minimum combined cleanliness value of 71 calculated by the percent of material used from each stockpile.
 - If the material from a proposed source fails this test requirement, the material may still be used for concrete aggregate provided that it is incorporated in an approved mix design with an approved Type F or Type N Pozzolan, or with a Type IP cement.
- C. If a pozzolan is used for this purpose, use 1 part pozzolan to 4 parts of cement by mass. The pozzolan quantity shall be considered as cement in meeting the required minimum cement content. If a Type IP cement is used for this purpose, the use of pozzolan is not required.

706.03.02 LIGHTWEIGHT AGGREGATES

- A. These aggregates shall conform to the following requirements:

Table 6 - Lightweight Aggregate Gradation

Sieve Size	Percentage of Weight Passing Sieve			
	Fine Natural	Fine Lightweight	1-inch Size Coarse	3/4-inch Size Coarse
1-inch	--	--	95-100	100
3/4-inch	--	--	--	90-100
1/2-inch	--	--	25-60	--
3/8-inch	100	100	--	20-60
No. 4	95-100	85-100	0-10	0-10
No. 16	45-80	40-80	--	--
No. 50	10-35	10-35	--	--
No. 100	2-12	5-25	--	--
No. 200	0-5	--	--	--

Table 7 - Lightweight Aggregate Properties

Tests	Test Method	Requirements
Sieve Analysis	AASHTO T27	Above 706.03.02.A.1 below
Sampling	ASTM D75	--
Unit Weight (loose oven dry) Fine Aggregate 70 lb/ft ³	Nev. T487	Maximum 706.03.02.A.2 below
Unit Weight (loose oven dry) Coarse Aggregate 55 lb/ft ³		
Unit Weight (loose oven dry) Combined Fine and Coarse Aggregate 65 lb/ft ³		

Table 7 - Lightweight Aggregate Properties

Tests	Test Method	Requirements
Organic Impurities	ASTM C40	Satisfactory 706.03.02.A.3 below
Clay Lumps	AASHTO T112	2.0% Maximum
Test for Staining Materials	ASTM D330	Satisfactory 706.03.02.A.4 below
Mortar Making Properties of Sand	ASTM C87	95% Minimum 706.03.02.A.5 below

1. With the following exceptions: The weight of the test sample for the fine lightweight aggregate shall be in accordance with Table 8, and the aggregate when mechanically sieved shall be sieved for only 5 minutes. The test sample for coarse aggregate shall consist of no less than 0.1 cubic foot of the material used for the determination of unit weight.

Table 8 - Weight of Sieve Test Sample for Fine Lightweight Aggregates

Nominal Weight of Aggregate		Weight of Test Sample	
(lbs/ft ³)	kg/m ³	Grams	Oz.
25-35	401-561	150	5.3
35-45	561-721	200	7.0
45-55	721-881	250	8.8
55-65	881-1042	300	10.6
65-70	1042-1122	350	12.3

2. The unit weight of successive shipments of lightweight aggregate shall not differ by more than 10 percent from that of the sample submitted for acceptance tests.
3. Aggregates tested and showing color darker than the standard shall be rejected unless it can be demonstrated that the discoloration is due to small quantities of materials not harmful to the concrete.
4. Aggregates tested and showing stain darker than "heavy stain" (stain index of 80) shall be tested by chemical procedure, and aggregates that contain 1.5 mg or more of ferric oxide (Fe₂O₃) per 200 gram sample shall be rejected for use.
5. Fine Aggregate failing in the test for organic impurities (ASTM C40) may be used provided that when tested for effect of organic impurities on strength of mortar, the relative strength at 7 and 28 days calculated in accordance with ASTM C87 is not less than 95 percent.

706.03.03 FINE AGGREGATE

- A. This aggregate shall conform to the following requirements:

Table 9 - Fine Aggregate Gradation

Sieve Sizes	Percentage by Weight Passing Sieve
3/8-inch	100
No. 4	95-100
No. 16	45-80
No. 50	10-35

Table 9 - Fine Aggregate Gradation

Sieve Sizes	Percentage by Weight Passing Sieve
No. 100	2-12
No. 200	0-5

Table 10 - Fine Aggregate Properties

Tests	Test Method	Requirements
Sieve Analysis	AASHTO T27	Above
Sampling Aggregate	ASTM D75	--
Soundness (5 alternations) (sodium sulfate)	AASHTO T104	10% Maximum Loss
Clay Lumps	AASHTO T112	1.0% Maximum
Lightweight Pieces in Aggregate (less than 2.0 sp. gr.)	AASHTO T113	1.0% Maximum
Organic Impurities	ASTM C40	Satisfactory 706.03.03.A.2 below
Mortar Making Properties	ASTM C87	95% Minimum 706.03.03.A.1 below

1. Aggregates tested and showing color darker than the standard shall be rejected unless they pass the mortar making properties test in accordance with ASTM C87.
2. Fine aggregate failing in the test for organic impurities (ASTM C40) may be used provided that when tested for effect of organic impurities on strength of mortar, the relative strength of 7 and 28 days calculated in accordance with ASTM C87 is not less than 95 percent.
3. If the material from a proposed source fails this test requirement, the material may still be used for concrete aggregate provided that it is incorporated in an approved mix design with an approved Type F or Type N Pozzolan, or with a Type IP cement.
 - a. If a pozzolan is used for this purpose, use 1 part pozzolan to 4 parts of cement by mass.
 - b. The pozzolan quantity shall be considered as cement in meeting the required minimum cement content.
 - c. The limitation on replacement of cement with pozzolans at a minimum of 20 percent in **Subsection [501.02.03](#), "Admixtures,"** is hereby waived to meet this requirement.
 - d. If a Type IP cement is used for this purpose, the use of pozzolan is not required.

706.03.04 GROUT AND MORTAR SAND

- A. This aggregate shall conform to the following requirements:
- B. Sand for grout and mortar shall conform to the size requirements of **Subsection [706.03.03](#), "Fine Aggregate,"** except if the Contractor elects, Contractor may screen the sand over a No. 8 screen to produce the following:

Table 11 - Grout Aggregate Gradation

Sieve Sizes	Percentage by Weight Passing Sieve
No. 8	100
No. 50	15-40

Table 11 - Grout Aggregate Gradation

Sieve Sizes	Percentage by Weight Passing Sieve
No. 100	0-10
No. 200	0-5

Table 12 - Grout Aggregate Properties

Tests	Test Method	Requirements
Sieve Analysis	AASHTO T27	Above
Sampling Aggregate	ASTM D75	-----
Organic Impurities	ASTM C40	Satisfactory 706.03.04.B.2
Mortar Making Properties	ASTM C87	95% Minimum 706.03.04.B.1

1. Aggregates tested and showing color darker than the standard shall be rejected unless they pass the mortar making properties test in accordance with ASTM C87.
2. Fine aggregate failing in the test for organic impurities (ASTM C40) may be used provided that when tested for effect of organic impurities on strength of mortar, the relative strength at 7 and 28 days calculated in accordance with ASTM C87 is not less than 95 percent.

706.03.05 RIPRAP GROUT

- A. The mix design for the placing requirements addresses 2 placement methods:
 1. Direct discharge from the transit mixer.
 2. Placement by small diameter line pumping methods.
- B. Two typical mixtures that would meet the above minimum requirements are as follows:

Table 13 - Proportions for 1.0 Cubic Yard of Grout

	Pump Method Approx. Volume (Cu. Ft.)	Transit Mixer Discharge Approx. Volume (Cu. Ft.)
Pea Gravel	3.5	7.6
Washed Concrete Sand	10.6	7.6
Water	6.5	5.9
Type V cement	3.5	3.1
Fly Ash class F	1.6	1.4
Balance Air	1.3	1.4

- C. Factors which shall be considered for a given grout mix are:
 1. Fine and coarse aggregates.
 2. Consistency.
 3. Elapse time between placement and initial set.
 4. Length of time between batching and placement during which continuous or intermittent mixing is required.
- D. Materials used in the production of riprap grout shall meet the minimum following material standards:

1. Fine and Coarse Aggregate: ASTM C33; **Section [206](#), "Structure Excavation."**
 2. Portland Cement: ASTM C150, Type V; **Section [701](#), "Hydraulic Cement."**
 3. Fly Ash: ASTM C618; **Section [729](#), "Fly Ash."**
 4. Water: **Section [722](#), "Water."**
 5. Air Entraining Admixture: ASTM C260; **Section [702](#), "Concrete Curing Materials and Admixtures."**
- E. A trial batch shall be placed for review by the Engineer for final approval for the project.
- F. The Engineer shall be provided with a legible ticket with each load of grout delivered to the project site which shall contain the following information:
1. Name of Vendor.
 2. Name of Contractor.
 3. Number of Cubic Yards in the Load.
 4. Actual Weights of Cement and of each Size of Aggregate.
 5. Amount of Water Added at the Plant.
 6. Amount of Water in the Aggregate.
 7. Brand and Type of Cement.
 8. Brand and Amount of Admixture.
 9. Time and Date of Batching.